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**RESPONSE TO COMMENTS RISK ASSESSMENT
WORK PLAN ADDENDUM OCTOBER 1991
FEBRUARY 1992**

02/01/92

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ENCLOSURE

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RISK ASSESSMENT WORK PLAN ADDENDUM
OCTOBER 1991**

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SUMMARY OF COMMENTS/RESPONSES

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Risk Assessment Work Plan Addendum
October, 1991
J. Frazier

Date Document Issued October 15, 1991
 Date Comments Due November 15, 1991
 Date Comments Received OEPA-November 22; EPA-December 4
 Date Report Due February 4, 1992

OEPA General Comments

1. Commenting Organization: OEPA Commentor:
 Pg. # Section # Paragraph # Sent./Line #
 Original Comment # 1

Comment: The Amended Consent Agreement (9/91) stated that the boundaries for operable units 1, 2, and 4 would be defined as approved in the RI/FS work plan addendum. No specific figures within the Risk Assessment Work Plan Addendum are called out to define these boundaries. DOE should explicitly propose operable unit boundaries within a section of this document and provide justification for the proposed boundaries.

Response: Section 1.7 of the Addendum presents three figures (Figures 1-2, 1-3, and 1-4) that define operable unit boundaries. The state planar coordinates of the boundaries for Operable Units 1, 2, and 4 are listed in Figure 1-2. The definition of Operable Unit 3 does not lend itself to defining geographical boundaries, and the definition of Operable Unit 5 (media in the regional area and production area) extends beyond the geographical boundaries of the FEMP; therefore, coordinates for Operable Units 3 and 5 are not specified. The first paragraph of Section 1.7 states that these three figures exist and that they present the information requested in the comment.

Action: Add the following sentence after the first sentence of Section 1.7: "The operable unit definitions listed in this work plan addendum are made to comply with the requirements in the modified Consent Agreement."

2. Commenting Organization: OEPA Commentor:
 Pg. # Section # Paragraph # Sent./Line #
 Original Comment # 2

Comment: Lack of Model Validation with Site Data - There is no feedback loop between the model results and measured field data. In particular, the groundwater flow and transport modeling can and should be validated to the extent possible. Similar to the uranium south plume modeling, comparison with historic data should be

0475 discussed and developed into the plan to improve model representation. The modeling work plan appears to understate the importance of a "reality check".

Response: DOE agrees with the comment.

Action: The model results will be checked for consistency with historic groundwater data to the extent possible. If calculated concentrations are found to differ significantly from observed concentrations, appropriate changes will be introduced into the model.

3. Commenting Organization: OEPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment # 3

Comment: Too Much Emphasis on Vadose Modeling - There is too much reliance on the use of vadose modeling. Unsaturated flow and transport analysis is a difficult and challenging area that requires more than the simple discussion presented in the work plan. There is also little justification that vadose modeling is even required. Because steady-state flow in the vadose is assumed, and little attention is paid to degradation in the vadose zone, there does not seem to [be] strong rationale for even including it in the analysis. In a one-dimensional representation, downward transport will reach steady-state conditions. This would result in a vertical concentration profile that parallels the moisture profile.

Response: DOE does not agree with this opinion. Contrary to the reviewer's statement, steady-state concentrations at the base of the vadose zone will not necessarily be reached before the contaminant in the source area is depleted. The reviewer should consider that, although steady-state flow in the vadose zone is assumed, source loading will be limited by the total mass of contaminant in the source. Thus, the source may be depleted of contaminants before equilibrium is reached at the base of the formation.

Vadose zone modeling will play an important role in determining the migration times of specific contaminants through the vadose zone to the aquifer. The glacial overburden will retard movement of different contaminants moving through the vadose zone at different rates. The velocity at which contaminants move in the vadose zone determines the time at which these materials reach the aquifer. Indeed the vadose zone may provide an effective barrier to some constituents if their rate of decay equals or exceeds the mass loading to the system. Vadose modelling will allow risk assessors to estimate the arrival time of these contaminants at the vadose/aquifer interface.

Finally, DOE recognizes that uncertainties are associated with any modeling process. The uncertainties associated with vadose modeling will be compensated for by making conservative assumptions and by documenting the possible impacts of known uncertainties on the reported results. The use of one-dimensional models is

consistent with this philosophy because such models ignore lateral dispersion and tend to overestimate contaminant concentrations.

Action: No action is required. No changes to the RI/FS Risk Assessment Work Plan Addendum are required.

Commenting Organization: OEPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment # 4

Comment: Selection of Parameter Values - In general, fate and transport models should be used to estimate upper-bound exposure point concentrations that may reasonably occur, in order to be consistent with the RME scenario. Parameter values used in fate and transport modeling should be selected with this in mind. Therefore, it may not be appropriate to use mean parameter values in most cases to reduce exposure point concentrations. Sensitivity analysis may be necessary to determine the impact that certain parameter values have on the results of the model. If significant differences in exposure point concentrations are obtained using a realistic range of model parameter values, then it may be appropriate to estimate exposure and risks based on a range of predicted exposure point concentrations.

Response: Many input parameters for the models are upper-bound estimates (e.g., the upper 95% confidence level on the mean is used to define the source term). In addition, the models themselves are conservative (e.g., in many cases, equations describe equilibrium conditions). Therefore fate and transport modeling results will be upper-bound estimates.

Action: No action required.

OEPA Specific Comments

Commenting Organization: OEPA Commentor:
Pg. # xvi Section # Paragraph # Sent./Line # 3
Original Comment # 1

Comment: Typo - correct "dose" to read "does".

Response: DOE agrees with the comment.

Action: Typo will be corrected.

6. **Commenting Organization:** OEPA **Commentor:**
Pg. # xviii **Section #** **Paragraph #** **Sent./Line # 1**
Original Comment # 2
- Comment:** Change "hazardous waste" to "hazardous substance".
- Response:** DOE agrees with the comment.
- Action:** "Hazardous waste" will be changed to "hazardous substance".
7. **Commenting Organization:** OEPA **Commentor:**
Pg. # 7 **Section # 1.7** **Paragraph #** **Sent./Line # 22**
Original Comment # 3
- Comment:** Correct OU2 definition to agree with that in the Amended Consent Agreement (9/91). Change "sanitary waste landfill" to "solid waste landfill".
- Response:** The noted phrase "sanitary waste landfill" will be changed to "solid waste landfill".
- Action:** In Section 1.7, page 7, line 22, change "sanitary waste landfill" to "solid waste landfill".
8. **Commenting Organization:** OEPA **Commentor:**
Pg. # 11 **Section # 1.7** **Paragraph #** **Sent./Line # 6**
Original Comment # 4
- Comment:** In order to agree with the Comprehensive Site-Wide Operable Unit definition in the Amended Consent Agreement (9/91), "... , as required by CERCLA, the NCP, and applicable U.S. EPA policy and guidance" must be added to the end of the sentence.
- Response:** The noted phrase will be added to the end of the sentence.
- Action:** In Section 1.7, page 11, line 6, add the following words to the end of the sentence "... , as required by CERCLA, the NCP, and applicable U.S. EPA policy and guidance."
9. **Commenting Organization:** OEPA **Commentor:**
Pg. # 8 **Section # 2.4** **Paragraph #** **Sent./Line # 17-19**
Original Comment # 5
- Comment:** The sentence suggests much of the data for the site has been presented in the RI/FS reports, yet only one operable unit RI has been submitted to the EPAs and it was not approved. The data may have been compiled in RI reports but these were never submitted. The paragraph should be rewritten.
- Response:** The paragraph will be revised to reflect the comment.

Action: In Section 2.4, page 8, first paragraph, revise the last sentence to read: "Although much of this information has been compiled and presented in draft reports for individual operable units, there has not been a presentation of all data to characterize the entire site and under the previous Consent Agreement schedules the only RI report delivered to EPA was for Operable Unit 4."

10. **Commenting Organization:** OEPA **Commentor:**
Pg. # 1 **Section # 3.0** **Paragraph #** **Sent./Line # 26**
Original Comment # 6

Comment: Describe the "DOE litigation studies" and include references for the studies.

Response: DOE litigation studies were performed in 1986 and 1987 to provide environmental characterization data in the vicinity of the FEMP. Surface soil, surface water, sediment, and groundwater were sampled under strict QA/QC practices and analyzed for selected contaminants to determine the nature and extent of potential impacts to off-property areas from past operations of the facility. The results of the studies were reported in two documents (IT 1986 and IT 1987) and were used in the class action lawsuit between residents near the FEMP and NLO, the former operator of the facility.

Action: The text in Section 3.0 will be revised to include the statement: "Data generated in DOE litigation studies of 1986-7 of off-property soil, surface water, sediment, and groundwater will be considered next because of the strict QA/QC practices applied in anticipation of their use in litigation (IT 1986, IT 1987)."

The list of references will be revised to add the following:

IT Corporation, 1986, "Interim Report - Air, Soil, Water, and Health Risk Assessment in the Vicinity of the FMPC, Fernald, Ohio," prepared for the U. S. Department of Energy, Oak Ridge, TN.

IT Corporation, 1987, "Addendum to Interim Report - Air, Soil, Water, and Health Risk Assessment in the Vicinity of the FMPC, Fernald, Ohio," prepared for the U.S. Department of Energy, Oak Ridge, TN.

11. **Commenting Organization:** OEPA **Commentor:**
Pg. # 1 **Section # 3** **Paragraph #** **Sent./Line # 20**
Original Comment # 7

Comment: Addendum to the Workplan should reference the most recent draft of the QAPP.

Response: Discussions in the addendum will be limited to the RI/FS QAPP cited until the RI/FS begins operation under the sitewide QAPP, which is currently under revision.

Action: In Section 3.0, page 1, line 23, add the following sentence to the end of the paragraph: "The RI/FS QAPP cited will be followed until the RI/FS begins operation under the sitewide QAPP, which is currently under revision."

12. Commenting Organization: OEPA Commentor:
Pg. # 2 Section # 3.1 Paragraph # Sent./Line # 10-11
Original Comment # 8

Comment: DOE should not be using supplemental sources of background data. Background for the site should be established as an integral part of the RI process and completed under the RI/FS QAPP.

Response: The background data collected for the site as part of the RI/FS include data from various sources, depending on the environmental medium. Site-specific background analytical results for groundwater are available from RI/FS wells designated as background wells on the basis of their locations upgradient from the FEMP. Site-specific surface water and sediment sample analytical results are available from RI/FS and WEMCO samples collected upgradient from the FEMP in areas not expected to have been influenced by operations at the FEMP. Concentrations for selected radionuclides and metals in surface soil have been assembled from regional data sources as background concentrations. DOE is preparing a list of contaminants by medium for which background concentrations have not been measured as part of the RI/FS.

In the absence of knowledge of background data for a contaminant in a specific medium, any detected concentration of the contaminant in the medium will be interpreted to indicate that the contaminant may be site-related and will be evaluated according to the criteria listed in Section 4.3.3.

(See also Comment Nos. 16, 17, 18, 19, 138, 150, and 153.)

Action: The word "supplemental" will be deleted from Section 3.0, page 2, line 11. The following will be added to line 10, page 2: "Background levels of chemicals and radionuclides include naturally-occurring levels and concentrations that are present in the environment due to human-made, non-site sources (EPA 1989a)."

Table 3-1 will be revised to indicate sources of background concentration data.

DOE will prepare a sampling and analysis plan (separate from the Risk Assessment Work Plan Addendum) for completion of the determination of background concentrations in soil for the RI/FS.

13. Commenting Organization: OEPA Commentor:
Pg. # 5 Section # 3 Paragraph # Sent./Line # 31
Original Comment # 9

Comment: Open literature sources for toxicity data must be checked by the Environmental Criteria and Assessment Office (ECAO) in Cincinnati.

Response: We assume ECAO will review the toxicity sections of the site-wide and individual operable units. We are not sure at this time which open literature sources may be used. (See also Comment Nos. 84 and 133.)

Action: No text change is required.

14. Commenting Organization: OEPA Commentor:
Pg. # 1 Section # 4 Paragraph # Sent./Line # 6-12
Original Comment # 10

Comment: First bullet: Screening rad instruments which are not specific should also be mentioned.

Response: Example field screening instruments for radiation will be identified.

Action: In Section 4.1, page 1, line 10, revise item (2) to read "(2) field screening instruments such as HNus, organic vapor analyzers, field instruments for detecting low energy radiation (FIDLERs), alpha particle scintillation detectors, and Geiger-Mueller (GM) detectors."

15. Commenting Organization: OEPA Commentor:
Pg. # 1 Section # 4.1 Paragraph # Sent./Line # 23-24
Original Comment # 11

Comment: If TICs appear often or TIC concentrations appear at high levels, then further evaluation of TICs is necessary, according to EPA (1989) guidance.

Response: DOE agrees with the comment.

Action: Section 4.1 will be revised to include the statement: "Tentatively identified compounds (TICs) will be included in the analysis if historical site information suggests the TICs may have been present at the site, and when TICs appear often or TIC concentrations appear at high levels, further evaluation of TICs will be performed (EPA 1989a)."

16. Commenting Organization: OEPA Commentor:
Pg. # 1 Section # 4.2 Paragraph # Sent./Line #
Original Comment # 12

Comment: This section appears to apply the guidance "Statistical Analysis of Ground water Monitoring Data at RCRA Facilities" to all media at the Site. This section must describe how statistical evaluation of background will be accomplished for media other than groundwater.

Response: Background concentrations are to be determined for each contaminant in each medium at a site from sufficient data for each contaminant in each medium in order that the distribution of site-specific background concentrations for each contaminant in each medium can be estimated. In other words, it is not sufficient to obtain a single estimate of the background concentration, but rather, sufficient data must be collected to determine the uncertainty and variability of the background concentration. The fact that there is a distribution of background concentrations is

a consequence of the statistical nature of sampling and analysis and the variability of concentrations of materials in environmental media.

(See also Comment Nos. 12, 17, 18, 19, 138, 150, and 153.)

Action: Section 3.0 will list the sources of background data. Section 4.2 will be revised to describe the method for evaluating background concentrations for the site.

17. **Commenting Organization:** OEPA **Commentor:**
Pg. # 2 **Section # 4.2** **Paragraph #** **Sent./Line # 5-7**
Original Comment # 13

Comment: DOE should incorporate Ohio EPA's policy "How Clean Is Clean" into the generation of tolerance intervals and the determination of background concentrations.

Response: DOE has reviewed Ohio EPA's policy "How Clean Is Clean" and has reservations regarding wholesale incorporation of the procedures specified in the document in light of other methodologies for evaluating data (including background data). Selection of the appropriate methodology for statistical treatment of data (including background data) must be resolved among EPA, Ohio EPA, and DOE. (See also Comment Nos. 12, 16, 18, 19, 138, 150, and 153.)

Action: DOE will discuss this subject with EPA and Ohio EPA to determine the appropriate methodology for statistical treatment of data. Section 4.0 will be revised in accordance with the resolution of this issue.

18. **Commenting Organization:** OEPA **Commentor:**
Pg. # 2 **Section # 4.2** **Paragraph #** **Sent./Line # 12-14**
Original Comment # 14

Comment: Three samples will not be adequate to characterize background and develop a tolerance interval. At a minimum DOE should collect 7 background samples (see Ohio EPA Policy, "How Clean is Clean").

Response: Although it is possible to construct a tolerance interval with as few as three observations, when too few background samples are taken and there is great variability in measured values, the upper tolerance limit will be high, and could exceed the maximum detected value. If possible, at least twelve (12) background concentration values, with at least 50% of the data exceeding the sample quantitation limit (SQL), will be used to establish the upper tolerance limit for each contaminant in each medium. If an insufficient number of background samples are available, non-parametric statistical methods will be used for comparison of site-related data to background data. (See also Comment Nos. 12, 16, 17, 19, 138, 150, and 153.)

Action: Section 4.2 will be revised to describe the method for performing the statistical evaluation of background data.

19. Commenting Organization: OEPA Commentor:
Pg. # 2 Section # 4.2 Paragraph # Sent./Line # 15-16
Original Comment # 15
- Comment: The sentence states the background samples will be tested for normality. The paragraph fails to discuss what steps DOE will take if the data is [sic] found to be not normal. DOE should provide specific steps which will be taken.
- Response: DOE agrees with the comment. (See also Comment Nos. 12, 16, 17, 18, 138, 150, and 153.)
- Action: The section will be revised to include a description of the specific steps to be taken if the distribution of background concentrations is not found to be normal or if there are too few background samples with which a test of normality can be performed.
20. Commenting Organization: OEPA Commentor:
Pg. # 5 Section # 4.3 Paragraph # Sent./Line # 5-7
Original Comment # 16
- Comment: As stated in the RAGS (1989) document such exclusion must be approved by the EPA. These exclusions should be made on a chemical specific basis and submitted individually to the EPAs for approval.
- Response: Unable to find specific statement in RAGS (1989) indicating that EPA approval is necessary prior to exclusion based on 5% or less detection. RAGs (1989) does indicate that approval from the Remedial Project Manager must be obtained. The use of a frequency of detection criterion is intended as a generality not an absolute rule. It is considered to be a valid criterion that can be used for risk assessments at Superfund sites. Nevertheless, the criterion will not be included in the revision of Section 4.3. (See also Comment No. 143.)
- Action: Section 4.3 will be revised without inclusion of the "frequency of detection" criterion for identifying chemicals of potential concern.
21. Commenting Organization: OEPA Commentor:
Pg. # 5 Section # 4.3 Paragraph # Sent./Line # 1-2
Original Comment # 17
- Comment: According to EPA (1989) guidance, one-half the Sample Quantification [sic] Limit (SQL) should be used as the surrogate concentration when the parameter is not detected.
- Response: DOE recognizes that EPA's Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A) provides guidance regarding the appropriate concentration to use for concentrations that are reported to be below sample quantitation limits (SQLs). EPA Region V has requested that a value of 1/2 SQL be used for all non-detects. (See also Comment Nos. 134, 140 and 144.)

Action: Section 4.2.2 will be revised to indicate that a value of ½ SQL will be used for all non-detects.

22. Commenting Organization: OEPA Commentor:
Pg. # 5 Section # 4.3 Paragraph # Sent./Line # 21-36
Original Comment # 18

Comment: Most chemical distributions in nature tend to be lognormally distributed (Connor and Shacklette 1975, Dean 1981, Esmen and Hammad 1977, and Ott 1988). Therefore, normal statistics may not be appropriate for these comparisons. A test for normality should be performed. In addition, a more refined statistical test may be appropriate for comparing background concentrations such as Cochran's approximation to the Behrens-Fisher Student t-test. For lognormal distributions, the monitoring data should be log-transformed when performing the statistical test.

Response: DOE agrees that distributions of chemicals in nature tend to be normal or lognormal, although other distributions can occur. The statistical treatment of background data and site-related data must first include a determination of the distribution type so that appropriate methods can be used to calculate the statistics for the data. (See also Comment Nos. 17, 19, and 63.)

Action: Section 4.2 will be revised to indicate how tests for normality will be performed for background sample populations and what statistical methodology will be applied to data that are not normally or lognormally distributed. Section 7.1 will be revised to indicate the methods of statistical treatment of site-related data.

23. Commenting Organization: OEPA Commentor:
Pg. # 7 Section # 4.3 Paragraph # Sent./Line # 4-6
Original Comment # 19

Comment: It should be noted that just because a contaminant is not a risk to human health it may present a risk to ecological receptors. Contaminants which present a risk to ecological receptors must be kept as contaminants of concern even if they pose little or no risk to human receptors. The NCP clearly provides for remediation based upon risks to the environment alone.

Response: DOE agrees with the comment. This is the intent of the work plan addendum, but it is not clear in the draft text. All chemicals identified as chemicals of potential concern will be evaluated in the ecological assessment and will not be eliminated on the basis of human health risk considerations such as the concentration-toxicity screening procedure. (See also Comment Nos. 160 and 275.)

Action: Revise the last paragraph of Section 4.3 to read:

"All chemicals identified as chemicals of potential concern prior to screening for human health risk will be evaluated in the ecological assessment. Because ecological receptors currently have access to the FEMP site, no distinction will be made

between present and future chemicals of potential concern, as will be the case in the human health risk assessment."

24. Commenting Organization: OEPA Commentor:
Pg. # 1 Section # 5 Paragraph # Sent./Line # 24
Original Comment # 20

Comment: "Is" should be "will be" since RI reports have not been prepared.

Response: DOE agrees with the comment.

Action: Change "is" to "will be" in the referenced sentence.

25. Commenting Organization: OEPA Commentor:
Pg. # 3 Section # 5.1.1.3 Paragraph # Sent./Line #
Original Comment # 21

Comment: Figure 5-1: Add a legend with scale and north arrow. Correct "Site Boundary" to "Property Boundary".

Response: DOE agrees with the comment.

Action: Suggested changes will be made.

26. Commenting Organization: OEPA Commentor:
Pg. # 14 Section # 5.1.3.2 Paragraph # Sent./Line # 15
Original Comment # 22

Comment: Typo - correct "dispensable" to rad [sic] "dispersable".

Response: DOE agrees with the comment.

Action: Typo will be corrected.

27. Commenting Organization: OEPA Commentor:
Pg. # 12 Section # 5.1.4 Paragraph # Sent./Line # 13
Original Comment # 23

Comment: The 1990 census data should be used to help define potentially exposed populations.

Response: The 1990 census data will be used in RI/FS risk assessments to help determine potentially exposed populations in the risk assessments.

Action: In Section 5.1.4.1, page 12, line 30, add the following sentence: "Subpopulations of potential concern will be identified in RI/FS risk assessments using 1990 census data."

28. Commenting Organization: OEPA Commentor:

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Pg. # 13 Section # 5 Paragraph # Sent./Line # 20-23
Original Comment # 24

Comment: This sentence is incorrect. Suggested rewording - "The Great Miami River supports no commercial fisheries in the vicinity of the FEMP, but recreational fishing occurs downstream of the FEMP. A fishing advisory for PCBs in bottom feeding fish was issued in 1989 by the Ohio Department of Health based on data collected by Ohio EPA". The advisory is only for bottom feeding fish such as carp and catfish.

Response: DOE agrees with the comment.

Action: Sentence will be reworded.

29. **Commenting Organization:** OEPA **Commentor:**
Pg. # 13 Section # 5.1.4.1 Paragraph # Sent./Line # 24-31
Original Comment # 25

Comment: The paragraph should be corrected to state the Paddys Run Road Site and the Proctor and Gamble research facility are listed on CERCLIS. The paragraph should additionally state that the Paddys Run Road Site is undergoing a state-lead RI/FS and that the Proctor and Gamble research facility has undergone a Screening Site Inspection by the USEPA.

Response: The paragraph will be revised to reflect the comment.

Action: In Section 5.1.4.1, page 13, last bullet, revise the third sentence to read: "Collectively known as the Paddys Run Road Site, these facilities are classified as CERCLA sites, are listed on the Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS), and are undergoing a state-lead RI/FS."

In Section 5.1.4.1, page 13, last bullet, revise the fourth sentence to read: "Proctor & Gamble has a research facility approximately two miles east of the FEMP, which is listed on CERCLIS and has undergone a Screening Site Inspection by U.S. EPA."

30. **Commenting Organization:** OEPA **Commentor:**
Pg. # Section # 5.1.4.1 Paragraph # Sent./Line #
Original Comment # 26

Comment: The RAGS document discusses subpopulations with respect to the site. DOE should not measure distances from the center of the FEMP but from the perimeter of the site, including the South Plume area.

Response: Population estimates for the RI/FS use the standard approach of estimating populations from the source of emissions. Because of the difficulty in preparing a separate population estimate for each source of emissions at the site, the center of the FEMP was chosen as the source and center point for estimating potentially exposed populations.

Action: In Section 5.1.4.1, page 12, line 30 add the following after the last sentence of the line:

"The information presented on sensitive subpopulations covers the area within a five-mile radius centered on the FEMP and covers the area within a radius of between three and four miles from the leading edge of the South Plume. Within this distance from the South Plume the population difference based on 1990 census data is negligible and the descriptions of the potential sensitive subpopulations are essentially the same."

31. **Commenting Organization:** OEPA **Commentor:**
Pg. # 18 Section # 5.1.5 Paragraph # Sent./Line # 29
Original Comment # 27

Comment: It is highly unlikely that striped bass (*Morone saxatilis*) were collected from the Great Miami River. Striped bass are not native to Ohio and have met with very limited stocking success in the State (Fishes of Ohio, Milton Trautman, 1981, Ohio State University Press). Hybrid striped bass have been stocked into the Ohio River. It is more likely that the fish actually collected were white bass (*Morone chrysops*), similar in appearance to the striped bass and native to Ohio. If voucher specimens were collected and archived, the specimens should be verified by an independent ichthyologist.

Response: The study identifying striped bass in the Great Miami River was conducted by the University of Cincinnati for the WEMCO environmental monitoring program. The suggestion that white bass may have been misidentified as striped bass will be referred to the U.C. researchers.

Action: Reference to striped bass will be deleted from the text.

32. **Commenting Organization:** OEPA **Commentor:**
Pg. # 20 Section # 5.2.1 Paragraph # Sent./Line # 3
Original Comment # 28

Comment: Some sources might be in direct contact with groundwater. This scenario should be included in the potential water exposure pathways.

Response: DOE agrees with the comment. This section does not clearly address the potential of waste to lie within a perched saturated zone. In some waste units, waste may lie within a perched groundwater zone that is present in the glacial overburden. In this situation, contaminants may be leached from the waste by contact with the groundwater. However, this groundwater must still move downward through an underlying unsaturated zone to reach the Great Miami Aquifer. See Comment Nos. 42 and 51.

Action: A sentence describing submerged waste sources will be added to the paragraph.

33. **Commenting Organization:** OEPA **Commentor:**

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Pg. # 21 Section # 5.2.2 Paragraph # Sent./Line # 19
Original Comment # 29

Comment: The air exposure pathway should include all sources that may be releasing radon to the air. Data from other sources at the Site should be evaluated to determine if radon is released into the air.

Response: Radon is a gaseous contaminant. It is the intent of the work plan to provide the methodology required to investigate risks from all sources of gaseous and volatile contaminants at the FEMP.

Action: Insert radon and acetone as examples of gaseous and volatile contaminants, respectively.

34. Commenting Organization: OEPA Commentor:
Pg. # Section # 5.3 Paragraph # Sent./Line #
Original Comment # 30

Comment: Two exposure routes that were not considered in the baseline risk assessment and perhaps should be evaluated include (1) dermal contact with sediments, and (2) incidental ingestion of surface water while swimming. The models and exposure parameters for these additional routes should be added to the report.

Response: The pathway involving dermal contact with sediments is already included in Section 5.2.4, where potential sediment exposure pathways are first established. The methodology for quantifying this pathway is presented in Section 7.2.1.7 because RAGS specifies the use of the same intake equation that is used to quantify intake from dermal contact with contaminated soil. The pathway involving incidental ingestion of surface water while swimming will be included in Section 5.2.1, where potential water exposure pathways are first established. The methodology for quantifying this pathway will be added to Section 7.2.

Action: Revise the text in Section 5.2.1, page 20, line 33 to include the pathway involving incidental ingestion of surface water while swimming (the exact wording is presented in the Action for Comment No. 64). Add both dermal absorption and accidental ingestion while swimming to Table 5.3. Add a new section to Section 7.2, which presents the methodology for quantifying the intake for this pathway (the exact wording is also presented in the Action for Comment No. 64).

35. Commenting Organization: OEPA Commentor:
Pg. # 32 Section # 5.4.1 Paragraph # Sent./Line #
Original Comment # 31

Comment: Table 5-4: DOE should discuss the reason for choosing an adult as the RME for current situation, for OU 3. It is standard to use a child when calculating risk from soil ingestion.

Response: It is not the intent of this table to include the results of a finished risk assessment, or include all of the pathways and locations that must be analyzed to perform one. This table contains our current best estimate of RME locations and the dominant exposure pathways, and is subject to change upon completion of a baseline risk assessment. The title of the table reflects this by including the word "examples". The pathways listed are examples of what the pathway producing the greatest amount of risk might be, and where the maximum exposure may be located. It should be noted that there is no intent to bias the risk assessment towards the pathways and locations listed in the table. All reasonable pathways will be evaluated. In addition, new guidance (RAGS, Part B) suggests that the RME for soil ingestion is a 70-kg adult who ingests 109 mg/day of soil, 350 days/year for 70 years.

Action: Add total soil ingestion rate in Section 7.2.2.1 of 109 mg/day. Clarify Table 5-4 by splitting current situation into two situations: 1) with and 2) without access controls.

36. **Commenting Organization:** OEPA **Commentor:**
Pg. # 33 Section # 5.0 Paragraph # Sent./Line # 8-11
Original Comment # 32

Comment: Please explain why the current situation RME for O.U.'s 2 & 3 only consider one exposure route. A trespasser in these areas, would most likely be exposed by more than one route (e.g. inhalation, dermal contact, direct radiation exposure, etc.).

Response: It is not the intent of this table to include the results of a finished risk assessment, or include all of the pathways and locations that must be analyzed to perform one. This table contains our current best estimate of RME locations and the dominant exposure pathways, and is subject to change upon completion of a baseline risk assessment. The title of the table reflects this by including the word "examples". The pathways listed are examples of what the pathway producing the greatest amount of risk might be, and where the maximum exposure may be located. It should be noted that there is no intent to bias the risk assessment towards the pathways and locations listed in the table. All reasonable pathways will be evaluated.

Action: Text reflecting the response will be added to Section 5.4.1.

37. **Commenting Organization:** OEPA **Commentor:**
Pg. # 35 Section # 5.5 Paragraph # Sent./Line # 5
Original Comment # 33

Comment: This section should describe how analytical results will be studied to determine if they are sufficient to conduct the quantitative evaluation of exposure pathways.

Response: DOE agrees with the comment.

Action: Section 5.5 will be revised to describe how available analytical results will be evaluated to determine if they are sufficient to conduct quantitative evaluation of exposure pathways.

38. Commenting Organization: OEPA Commentor:
Pg. # Section # 6 Paragraph # Sent./Line #
Original Comment # 34

Comment: Section 6 does not present a model for estimating exposure point concentrations for VOCs released from groundwater while showering. Inhalation of VOCs while showering may be an important exposure route.

Response: DOE agrees with the comment. (See also Comment No. 211.)

Action: The Andelman model (from RAGS Part B) describing volatilization from water used in the home will be used to estimate exposure point concentrations for VOCs.

39. Commenting Organization: OEPA Commentor:
Pg. # 1 Section # 6.0 Paragraph # Sent./Line # 13
Original Comment # 35

Comment: How were the models listed in Table 6-1 chosen? What was [sic] the criteria used in model selection? What if other models are found to be needed during the course of the assessment?

Response: The models listed in Table 6-1 are a collection of models which have either been widely used, or were developed/adapted specifically for the FEMP.

For example, EQ3NR and companion code EQ6 are industry standard solubility/speciation/reaction path computer programs developed primarily to solve problems related to nuclear waste disposal. EQ3NR/EQ6 contains the most comprehensive thermodynamic database of all publicly-available geochemical codes. EQ3NR/EQ6 has been validated using standard geochemistry problems such as the speciation of seawater, basalt/sea water interactions, numerous comparisons with experimentally-determined mineral solubilities. Benchmark comparisons with the results of similar codes have been performed.

EQ3NR is similar to other solubility/speciation codes. EQ6 uses an input file that is generated by the EQ3NR code. This allows reaction path modeling to be carried out in a time-efficient manner, giving EQ3NR/EQ6 an advantage over other geochemical modeling programs.

ST1D and ODAST are well known analytical solutions and, as mentioned on p. 13, lines 18-19 they have been checked against another program. The selection of SWIFT III was discussed in the groundwater modeling work plan. It was the only well-verified program capable of three-dimensional treatment of flow and solute

transport available at the time which included adsorption, radioactive decay and other desired features.

As stated in the text, this list is not all inclusive. Additional models can be added to this list, subject to need and the approval of EPA.

Action: No action required.

40. Commenting Organization: OEPA Commentor:
Pg. # 1 Section # 6.0 Paragraph # Sent./Line # 20
Original Comment # 36

Comment: How would one cross-check results from different models? As listed in the groundwater area, only one model is to be used. There appears to be too much focus on differences between models with little regard for true model verification or validation with field data.

Response: Cross-checking of results of analytical solutions would be done by using another code that can solve the same problem. For example, using STRIP1B to check a critical result obtained from ST1D or ODAST. SWIFT III code verification is presented in the Fernald RI/FS Groundwater Modeling, Flow and Solute Transport Computer Code Verification, Final Report, (IT, 1990).

As discussed in response to comment OEPA 39, EQ3NR/EQ6 has been validated and benchmarked against similar codes.

Action: No action is required.

41. Commenting Organization: OEPA Commentor:
Pg. # 2 Section # 6 Paragraph # Sent./Line #
Original Comment # 37

Comment: Why is SESOIL model listed, but not discussed in later sections?

Response: SESOIL was presented in the table as an alternate vadose zone code. A complete discussion of alternative codes was not intended.

Action: No text change is required.

42. Commenting Organization: OEPA Commentor:
Pg. # 4 Section # 6.1 Paragraph # Sent./Line # 2-10
Original Comment # 38

Comment: The section fails to address the potential for waste to lie within the zone of saturation. This may be the case in some of the land disposal units, such as the lime sludge lagoons.

Response: DOE agrees with the comment. This paragraph does not clearly address the potential of waste to lie within a perched saturated zone. In some waste units, waste may lie within a perched groundwater zone that is present in the glacial overburden. In this situation, contaminants may be leached from the waste by contact with the groundwater. However, this groundwater must still move downward through an underlying unsaturated zone to reach the Great Miami Aquifer. See Comment No. 32.

Action: Lines 6 through 10 will be revised to more clearly address this possibility. Geochemical modeling will address any expected differences in water chemistry in the vadose and phreatic water.

43. **Commenting Organization:** OEPA **Commentor:**
Pg. # 4 **Section # 6.1.1** **Paragraph #** **Sent./Line # 30**
Original Comment # 39

Comment: It is unclear how a reaction path code will be used in conjunction with a fate and transport assessment. There are several codes that address geochemical mixing. One example, FASTCHEM, couples geochemical modeling and transport. (See Mangold and Tsang, 1991, for others.) The saturated-unsaturated flow field is simulated, defined into a number of stream-tubes and water chemistry is updated with space and time.

Response: Reaction path modeling will be used to simulate the production of leachate by modeling the interaction between waste solids and infiltrating water (Leachate A as discussed in Section 6.1.1.1). The interaction between leachate and subsurface solids will also be simulated by reaction path modeling (Leachate B, Section 6.1.1.1). The resulting contaminant concentrations from Leachates A and B will be used as initial (source) concentrations in the transport model. Thus the reaction path model is used to define source concentrations for the transport model; the two models are not coupled.

Coupled models do exist. In the absence of site-specific reaction kinetics data, assumptions regarding reaction rates must be made. Thus, based on available FEMP RI/FS data, it is questionable whether a coupled model approach would be more accurate or appropriate than the proposed approach.

Action: No action is required.

44. **Commenting Organization:** OEPA **Commentor:**
Pg. # 4 **Section # 6.1** **Paragraph #** **Sent./Line # 26**
Original Comment # 40

Comment: The use of a solubility-limited source term could potentially lead to significant over estimation of the source concentration. Environmental measures of groundwater samples rarely display many of the organic compounds at or even near their solubility limits.

Response: DOE agrees with the comment. However, given the available data, these are the only defensible source concentrations. Currently, leachate samples from several waste units are being collected and analyzed. Leachate samples will not be available for all waste units, and not from contaminated soil. When the results of this program become available, they will provide actual source concentrations and eliminate the uncertainty (and potential "overly-conservative" concentrations) associated with geochemical modeling.

Action: No action is required.

5. **Commenting Organization:** OEPA **Commentor:**
Pg. # 6 **Section # 6.1.1.1** **Paragraph #** **Sent./Line # 10**
Original Comment # 41

Comment: Why is leachate A expected to be significantly different from leachate B? While this applies only to inorganics, of what significance is the change in water chemistry through the vadose zone? There seems to be too much focus on modeling and too little attention to field validation of this conceptual model.

Response: The glacial overburden mineralogy is expected to be quite different than that of the aquifer (i.e., clay minerals versus sand and gravel composed of principally quartz and carbonates). Thus transport through the overburden, and thus, the vadose zone, may greatly affect contaminant concentrations in infiltrating water by the interaction with overburden solids.

The composition of Leachate A can be significantly different than the composition of Leachate B. Leachate A will be simulated by the reaction of rainwater or groundwater with waste solids. Leachate B will be simulated by the reaction of Leachate A with glacial overburden minerals. In the formation of Leachate B, contaminant concentrations may be reduced by reaction with overburden minerals. For example, it is expected that Leachate A from several waste units (e.g., the fly ash piles) will be basic. Reaction with overburden minerals will neutralize the high-pH Leachate A, potentially influencing the solubility and speciation of contaminants.

Geochemical modeling of the reactions between infiltrating leachate and vadose zone (glacial overburden) solids will be used to estimate these interactions.

Action: No change in text is required. Existing data and additional waste characterization currently underway will be used in conjunction with perched groundwater chemistry data to estimate the validity of the proposed geochemical modeling approach for operable unit risk assessments.

46. **Commenting Organization:** OEPA **Commentor:**
Pg. # 11 **Section # 6.1.2.1** **Paragraph #** **Sent./Line # 15**
Original Comment # 42

Comment: What are water and waterborne materials? Is this an indirect reference to dissolved (miscible) transport and non-aqueous (immiscible) transport processes?

Response: The sentence refers to miscible transport.

Action: "Water and waterborne" will be changed to "dissolved."

47. Commenting Organization: OEPA Commentor:
Pg. # 11 Section # 6.1.2.1 Paragraph # Sent./Line # 18
Original Comment # 43

Comment: While gravity drainage is important, capillarity should also be mentioned here. Imbibition into dry soils can exceed gravity effects. Also it is capillarity that allows the perched zones to exist.

Response: DOE agrees that capillary effects are important in the vadose zone. However, gravity is the prime mover of most groundwater systems.

Action: Capillarity will be mentioned in Section 6.1.2.1.

48. Commenting Organization: OEPA Commentor:
Pg. # 11 Section # 6.1.2.1 Paragraph # Sent./Line # 20
Original Comment # 44

Comment: The text now places greater reliability on measured leachate data and suggests that modeling (geochemical) will be reserved for constituents where data are not available. The document should be more direct and clear on this most important issue.

Response: Agreed, this point is confusing. Leachate from several FEMP waste units is currently being collected and analyzed. Use of the resulting data to determine the composition of Leachate A is favored over the geochemical-modeling approach for reasons discussed in Section 6.1.1.5 of the Risk Assessment Work Plan Addendum. The work plan addendum does not specify the Operable Units (or waste units) from which leachate will have been sampled, but it will be presented in the Remedial Investigation (RI) report for individual Operable Units. See response to Comment # 50.

Action: The text will be modified to reflect the response. See action accompanying response to Comment No. 50.

49. Commenting Organization: OEPA Commentor:
Pg. # 11 Section # 6.1.2.1 Paragraph # Sent./Line # 22
Original Comment # 45

Comment: It is not appropriate to use a one-dimensional representation in the vadose zone cutting through high and low permeability sections. This will lead to a conservative

transport analysis. Because water will follow the path of least resistance (i.e., preferentially through high permeability zones), the model should follow these paths.

Response: DOE recognizes that a one-dimensional representation of the vadose zone is conservative regardless of the flow path. If more realistic flow paths can be determined from the available data, the one-dimensional model will follow these paths. In the absence of sufficient information to determine the flow path, a conservative path will be used. Using a one-dimensional representation of contaminant transport in the vadose zone will lead to a conservative assessment of risks from groundwater.

Action: No text change is required.

40. **Commenting Organization:** OEPA **Commentor:**
Pg. # 11 **Section # 6.1.2.1** **Paragraph #** **Sent./Line # 32**
Original Comment # 46

Comment: There is no elaboration on the integration of the geochemical and flow models. What is implied here? Do you start with EQ3 analysis of the waste unit (leachate A), then simulate flow and transport through glacial overburden, follow with another EQ3 mixing and then continued transport to the water table?

Response: Leachate A is produced by geochemical modeling of the interaction of rainwater with waste material. Alternatively, the composition is also used to simulate the production of Leachate B by the reaction of Leachate A with glacial overburden mineralogy. The concentration of contaminants of interest from Leachate B are used as input in the vadose zone transport model.

Action: Section 6.1 will be revised.

51. **Commenting Organization:** OEPA **Commentor:**
Pg. # 13 **Section # 6.1.2.2** **Paragraph #** **Sent./Line # 1**
Original Comment # 47

Comment: The models discussed are limited to one steady Darcy flux. Why is there no discussion of more detailed models such as SESOIL (Table 6-1)? The section seems to imply that vadose flow and transport modeling is comparable in difficulty and certainty as [sic] saturated models. Transport in the vadose will be significantly more difficult and subject to greater degrees of uncertainty. There is no substantiation that vadose modeling is required for the assessment. Based on the fact that contamination is known to exist in the saturated portion of the aquifer, why perform vadose modeling?

Response: Vadose modeling is required to provide a realistic estimate of future contamination at receptor sites due to migration to the Great Miami Aquifer from the glacial overburden. The groundwater modeling performed in support of the 1990 Consent Agreement has already shown that most of the present contamination in the aquifer entered directly into the aquifer from Paddys Run where its bed encounters the

aquifer. Contamination of the aquifer in the waste pit area has been by fairly direct paths, because very little glacial overburden separates the pit bottoms from the aquifer and because sandy lenses are present. Thick glacial overburden, if present, presents a significant mechanism for retardation and immobilization of contaminants. It is suspected that retardation due to adsorption, combined with radioactive decay, will prevent some radionuclides from reaching the aquifer when decay rates equal or exceed source loading rates. Precipitation of minerals may be found to virtually immobilize some contaminants as well. The effect of retardation combined with depletion of sources may cause source loadings to the Great Miami Aquifer to be much less than they would be in the absence of the glacial overburden. (See also Comment Nos. 3, 41, 49 and 55.)

Action: DOE will substantiate that vadose modeling is required. DOE will explicitly state that vadose modeling is difficult and subject to a high degree of uncertainty.

52. Commenting Organization: OEPA Commentor:
Pg. # 13 Section # 6.1.3 Paragraph # Sent./Line # 21
Original Comment # 48

Comment: What are water and waterborne materials?

Response: The sentence refers to miscible transport. (See also Comment No. 46.)

Action: "water and waterborne" will be changed to "dissolved" in Section 6.1.3.

53. Commenting Organization: OEPA Commentor:
Pg. # 14 Section # 5 Paragraph # Sent./Line # 5
Original Comment # 49

Comment: Ohio EPA requests a copy of the Flow and Solute Transport Computer Code Verification Report.

Response: Comment acknowledged.

Action: A copy of the document will be provided.

54. Commenting Organization: OEPA Commentor:
Pg. # 14 Section # 6.1.3 Paragraph # Sent./Line # 24
Original Comment # 50

Comment: While transport is dependent on the properties of the aquifer, there is equal and possibly greater dependence on the properties of the dissolved constituent. The plan should also address degradation (biological and radioactive decay) and sorption processes.

Response: The referenced text is correct. The movement of contaminants in the aquifer is dependent on the physical and chemical properties of a given water-bearing stratum. Sorption results from the interaction of the chemical properties of the aquifer and

the chemical properties of the constituent moving through it. Sorption is discussed in Section 6.1.4.6. Radiological decay and the degradation of organic compounds effect the concentrations at the exposure point. Both the aquifer and vadose zone models included in this WPA account for exponential degradation.

Action: Create a new Section 6.1.4.7 entitled "Degradation Rates" and describe the development of the degradation rates used to model concentrations at the FEMP.

55. Commenting Organization: OEPA Commentor:
Pg. # 14 Section # 6.1.4.1 Paragraph # Sent./Line #
Original Comment # 51

Comment: There seems to be great emphasis on moisture content. The plan places great attention to this, but in the proposed modeling approach, this issue will be essentially lost. The steady Darcy flux approach in the vadose zone is dominated by uncertainty in the saturated hydraulic conductivity and assumed water flux (net recharge).

Response: DOE agrees that uncertainties in Darcy flux may prove to be dominated by uncertainties in saturated hydraulic conductivity and net recharge. However, it is felt that the effect of moisture content on effective hydraulic conductivity is sufficient to merit the presentation of the equation that will be used to estimate it.

Action: Retain the equation for estimating moisture content.

56. Commenting Organization: OEPA Commentor:
Pg. # 15 Section # 6.1.1 Paragraph # Sent./Line #
Original Comment # 52

Comment: Provide values of dispersivity (longitudinal and transverse) to be used. It is not generally accepted to use the same dispersivity in the vadose and saturated zones.

Response: DOE agrees with the comment.

Action: Values of dispersivity for the vadose and saturated zone will be added to Section 6.1.

57. Commenting Organization: OEPA Commentor:
Pg. # 16 Section # 6.1.4.2 Paragraph # Sent./Line # 24
Original Comment # 53

Comment: There are numerous techniques for estimating the unsaturated hydraulic conductivity and moisture retention relationships. There are many articles appearing in Soil Science Society of America. It is not appropriate to simply use values of conductivity from below the water table.

Response: DOE agrees with the comment.

Action: Section 6.1.4.2 will be revised to clarify that the hydraulic conductivities used for the vadose zone are not simply values from below the water table.

58. Commenting Organization: OEPA Commentor:
Pg. # 18 Section # 6.1.4 Paragraph # Sent./Line # 1
Original Comment # 54

Comment: If there is water ponded at ground surface, hydraulic [gradients] greater than 1.0 can exist. It would not be conservative to simply assume that the gradient will not exceed 1.0.

Response: DOE agrees with the comment. Hydraulic gradients will be based on best available field data.

Action: Change "= 1" to "> 1" on page 6-18, line 1.

59. Commenting Organization: OEPA Commentor:
Pg. # 20 Section # 6.1.4.6 Paragraph # Sent./Line #
Original Comment # 55

Comment: Table 6-3: a) The table fails to include a number of radionuclides known to be present on site (i.e., Ac-227, Pb-210, Rn-220). The table additionally fails to incorporate a number of inorganic contaminants at the FEMP. Table 6-3 should incorporate all radionuclide and inorganic constituents listed in Table 4-2. b) A reference for the data in the table should be provided.

Response: a) Lead is listed in Table 6-3. Due to its short half-life, Rn-220 will be in secular equilibrium with its parent, Ra-224, and probably with its long-lived precursor Th-232 as well. Kd's for thorium and radium are provided in Table 6-3. Actinium and seven inorganic compounds will be added to the table. b) DOE agrees that references for the Kd's in Table 6-3 should be provided.

Action: Table 6-3 will be revised to reflect the response.

60. Commenting Organization: OEPA Commentor:
Pg. # 19 Section # 6.1.4.6 Paragraph # Sent./Line # 14
Original Comment # 56

Comment: Include Cleary et al. (1991) in the list of references.

Response: DOE agrees with the comment.

Action: The reference will be included.

61. Commenting Organization: OEPA Commentor:
Pg. # 21 Section # 6.1.4.6 Paragraph # Sent./Line #
Original Comment # 57

Comment: Table 6-4: The table should incorporate all organic constituents listed in Table 4-2.

Response: DOE agrees that Table 6-4 and Table 4-2 should list the same constituents, using the same nomenclature and in the same order.

Action: Revise Table 6-4 and Table 4-2 to list the same constituents.

62. **Commenting Organization:** OEPA **Commentor:**
Pg. # 31 **Section # 6.3.2** **Paragraph #** **Sent./Line # 2**
Original Comment # 58

Comment: Reword the first sentence to make a complete sentence.

Response: The sentence will be reworded.

Action: In Section 6.3.2, page 31, the first sentence should read: "Estimating airborne concentrations of contaminants in the gaseous phase, such as volatile organic compounds (VOCs) and radon, involves modeling diffusion through media and dispersion in air following release."

63. **Commenting Organization:** OEPA **Commentor:**
Pg. # 2 **Section # 7.1** **Paragraph #** **Sent./Line #**
Original Comment # 59

Comment: The equation for estimating the 9th [sic] upper confidence limit (UCL) on the arithmetic mean concentration assumes that the chemical has a normal distribution. The equation presented in Gilbert (1987) (as cited in EPA [1989] guidance) for estimating the 9th [sic] UCL on the arithmetic mean, assuming a lognormal distribution, should be used when the chemical distribution is positively skewed. This approach may significantly change estimated exposure point concentrations.

Response: In accordance with EPA Region V guidance on selecting exposure point concentrations for the "baseline risk assessment future residential land use ground water scenario" (EPA 1991e), it is assumed that the contaminant concentration is that concentration at the center of the contaminant plume. If good monitoring well data exist, the exposure point concentration is calculated as the upper 95% confidence limit on the arithmetic mean for either a normal or log normal distribution of the contaminant concentration found in at least three monitoring wells located at the center of the contaminant plume. The maximum contaminant concentration is used if it is lower than the 95% confidence limit. (See also Comment Nos. 217 and 219.)

Action: Section 7.1 will be revised to be consistent with the guidance from EPA Region V regarding the derivation of exposure concentrations from measured data. The upper 95% confidence limit (UCL) on the arithmetic mean for either the normal or lognormal distribution will be calculated for site-related data.

The list of references will be revised to include:

United States Environmental Protection Agency, 1991e, "Future Residential Land Use Ground Water Exposure Point Concentrations for the Baseline Risk Assessment," memorandum from John Kelly to Remedial and Enforcement Response Branch RPMs and Supervisors, May 10, 1991, Region 5, Chicago, IL.

64. Commenting Organization: OEPA Commentor:
Pg. # Section # 7.2 Paragraph # Sent./Line #
Original Comment # 60

Comment: Exposure rates that were not considered in the baseline risk assessment and perhaps should be evaluated include: (1) dermal contact with sediments, (2) incidental ingestion of surface water while swimming, and (3) exposure to VOCs while showering (inhalation and dermal adsorption). The models and exposure parameters for these additional routes should be added to the report.

Response: Dermal contact with sediments is already included in Section 5.2.4 where potential sediment exposure pathways are first established. It is also indirectly presented in Section 7.2.1.7 because RAGS specifies the use of the same intake equation for quantification of intake from dermal contact with contaminated soil and sediments (this will be further clarified in Section 7.2.1.7). It was the intent of the work plan to include inhalation and dermal exposure to VOCs from showering in the domestic water use pathway. This was not clearly stated in the text describing the pathway. Incidental ingestion of surface water while swimming will be added to the list of potential pathways described in Section 5.0.

Action: Revise the sentence beginning on line 33, page 5-20 in Section 5.2.1 to read: "Additional exposures to contaminated water that do not involve the food chain include direct contact with contaminated water (potential dermal absorption of contaminants), inhalation and dermal exposure to radon or volatile organic compounds released from contaminated water during household use or agricultural use such as showering or spray irrigating, and incidental ingestion of surface water while swimming."

The Andelman model (from RAGS Part B) will be used for estimating VOC concentration in air from shower water.

Revise the sentence on line 21, page 7-12 in Section 7.2.1.7 to read: "Dermal absorption may also occur upon contact with contaminated soil and sediment and is calculated using the following equation (EPA 1989a):"

Insert a new Section 7.2.1.8 in Section 7.2 (existing Section 7.2.1.8 becomes Section 7.2.1.9):

7.2.1.8 Incidental Ingestion of Surface Water while Swimming

Intake from incidental ingestion of surface water while swimming is quantified using the following equation (EPA 1989a):

$$\begin{aligned} (\text{radionuclides}) I_{WS} &= (C_{WS})(CR)(ET)(EF)(ED) \\ (\text{chemicals}) I_{WS} &= (C_{WS})(CR)(ET)(EF)(ED)/(BW)(AT) \end{aligned}$$

where

I_{WS} = Intake from water while swimming (pCi) (mg/kg-day)

C_{WS} = Concentration in water (pCi/L) (mg/L)

CR = Contact rate (0.05 L/hour)

ET = Exposure time (hours/event)

EF = Exposure frequency (events/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (days)"

65. Commenting Organization: OEPA Commentor:
Pg. # 3 Section # 7.1 Paragraph # 1&2 Sent./Line #
Original Comment # 61

Comment: Please provide some justification for subtracting background concentrations of radionuclides but not chemicals.

Response: As noted in Comment No. 220, it is reasonable to subtract background concentrations of naturally-occurring radionuclides from on-site concentrations. There are also certain radionuclides present in the environment that are human-made (anthropogenic) and not a consequence of operations at the site. These anthropogenic background levels include concentrations such as those due to atmospheric weapons testing (fallout) consisting of radionuclides such as cesium-137, strontium-90, and ruthenium-106. Both naturally-occurring radionuclides and anthropogenic radionuclides from weapons testing fallout are ubiquitous to the FEMP area.

In order to assess human health risks that are a consequence of site-related contaminants, background concentrations (naturally-occurring background and anthropogenic background) are subtracted from concentrations in environmental media at potential receptor locations. Subtraction of background concentrations is performed for carcinogens or potential carcinogens but not for toxicants (for which a threshold for health effects is assumed to exist). (See also Comment Nos. 215 and 220.)

Action: Section 7.1 will be revised to include the following: "The 95% confidence limit on the arithmetic mean for the background concentration for each carcinogen (including radionuclides) will be subtracted from the site-related UCL for the carcinogen to determine exposure concentrations of carcinogens at exposure points. In this way the quantified exposure and risks that represent the excess attributable to contamination from the site can be presented. In addition, exposures to background concentrations of carcinogens (including radionuclides) will be assessed to provide the risks associated with exposures that are not attributed to the site. This information facilitates the important comparison of the background risks, the

added risks due to the site, and the total risk (background risk plus risk from the site).

Background concentrations of chemical toxicants will not be subtracted from UCL values when determining exposure point concentrations. Thus, the quantified exposure and risk represent that which is attributable to contamination from the site plus background."

66. Commenting Organization: OEPA Commentor:
Pg. # 6 Section # 7.2 Paragraph # Sent./Line # 18-19
Original Comment # 62

Comment: The averaging time for evaluating carcinogenic effects for all exposure pathways considered in the baseline risk assessment should be: 365 days x 70 years = 25,550 days (not 24,500 days).

Response: DOE agrees with the comment.

Action: The averaging time (AT) will be changed from 24,500 days to 25,550 days in all equations. Include the parenthetical citation (EPA 1991) in Section 7.2.2, page 13, lines 20 to 22. This citation corresponds to the following complete reference, which must be added to the Reference List:

"U.S. Environmental Protection Agency, 1991, "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors, Interim Final," EPA, Office of Emergency and Remedial Response, Washington, DC."

67. Commenting Organization: OEPA Commentor:
Pg. # 7 Section # 7.2 Paragraph # Sent./Line # 8-9
Original Comment # 63

Comment: It may not be appropriate to assume young children (i.e., 1 to 6 years) for evaluating exposure from incidental ingestion of soils while trespassing at the site under current land-use conditions. It may be more appropriate to assume older children for this pathway. Incidental ingestion of contamination [sic] on-site soils by young children may be appropriate for a residential scenario under future land-use conditions. For current land-use conditions, incidental ingestion of potentially contaminated household dust may be a more significant route to exposure to children in this study. If the air deposition pathway is significant, then such a pathway should be considered.

Response: Under current conditions, children who trespass along Paddys Run are assumed to be ages 6-17. For the future scenario, children, ages 1-6 who ingest 200 soil mg/day will be evaluated for daily exposure to noncarcinogens. For carcinogens, adults ingesting 114 mg soil/day will be evaluated. (See also Comment No. 35).

Action: Text will be modified to reflect response.

68. Commenting Organization: OEPA Commentor:
Pg. # 9 Section # 7 Paragraph # Sent./Line # 8
Original Comment # 64

Comment: Please define the variable (Biv[1]) and provide a reference for this equation.

Response: $B_{iv(1)}$ is defined on line 13 of page 8 of Section 7.0, where it is used in of Equations 7-8 and 7-9 (which are referenced). Equation 7-10 is merely a rearrangement of the definition of $B_{iv(1)}$. This parameter is discussed in Baes, et al., 1984, which is the first reference in the List of References.

Action: No action required.

69. Commenting Organization: OEPA Commentor:
Pg. # 12 Section # 7.2 Paragraph # Sent./Line #
Original Comment # 65

Comment: The equation for estimating exposure from direct contact with water is incorrect (the equation presented in EPA [1989] also was incorrect). The units for the permeability constant are "L/cm²/hr" (not cm/hr), and the conversion factor of "1 [sic] L/1000 cm³" should be dropped from the equation. The permeability constant for water is 8.4×10^{-4} L/cm²Hr [sic]. Thus, the equation presented in Section 7.2 on page 12 would underestimate this exposure route by a factor of 1000.

Response: EPA's "Interim Guidance for Dermal Exposure Assessment" (EPA/600/8-91/011A, March 1991) presents the same methodology used in the Human Health Evaluation Manual and the Superfund Exposure Assessment Manual with units of (cm/hr) for the permeability constant. This convention for expressing the permeability constant is also used in the peer reviewed technical literature. Perhaps a reference for the convention presented in the comment could be provided by Ohio EPA. Until such time the methodology presented in the Addendum will be used because it is consistent with all available EPA guidance documents on the subject. (See also Comment Nos. 75 and 213.)

Action: No text change is required.

70. Commenting Organization: OEPA Commentor:
Pg. # 13 Section # 7.2 Paragraph # Sent./Line #
Original Comment # 66

Comment: The "Standard Default Exposure Factors" document (EPA 1991c, as cited in this report) should be included in the heirarch [sic] presented on page 13.

Response: DOE agrees with the comment.

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Action: Include the citation for the supplemental guidance on exposure factors for RAGS in the second bullet of the hierarchy for parameter values presented at the beginning of Section 7.2.2, page 13, lines 20 to 22.

71. **Commenting Organization:** OEPA **Commentor:**
Pg. # 13 **Section #** **Paragraph #** **Sent./Line # 15**
Original Comment # 67

Comment: The default exposure assumptions recommended by U.S. EPA are to be used only in the absence of site-specific information. It would be incorrect to use default values if documented site-specific values were available.

Response: Site-specific parameter values will be used when available, EPA default parameter values will be used in the absence of site-specific data. Note that the first bullet in the hierarchy of sources of parameter values is site-specific data. The text will be modified to further clarify the hierarchy.

Action: Revise the sentence beginning on page 7-13, line 13 to read "Parameter values will be obtained from site-specific data whenever possible; however, in the absence of site-specific data, parameter values recommended by EPA will be used."

72. **Commenting Organization:** OEPA **Commentor:**
Pg. # 14 **Section # 7.2** **Paragraph #** **Sent./Line # 20-23**
Original Comment # 68

Comment: An assumed skin surface area for young children should be used in order to evaluate exposure from direct contact with soil. Total body surface areas may be appropriate for only certain exposure pathways such as showering or swimming. The surface areas of only portions of the body (e.g., a portion of the total surface area of the arms, hands, legs and feet) should be used when evaluating exposure from direct contact with sediments and/or soils.

Response: Skin surface areas for portions of the body will be added to Section 7.2.

Action: The following specific body-part information from new guidance will be provided in Section 7.2.

Surface Area (m ²)			
Applicable Pathway(s): Body Part	Child < 6 yrs	Child/Teen 6-18 yrs	Adult over 18 yrs
Swimming, bathing: Total body	0.7 ^a	1.33 ^b	1.81 ^c
Playing in creek:			
Forearms		0.078 ^d	
Hands		0.057 ^d	
Lower Legs		0.150 ^d	
Feet		0.077 ^d	

Dermal contact with soil during gardening, remediation activities:			
Forearms		0.078 ^d	0.114 ^e
Hands		0.057 ^d	0.079

^a Approximated from 50 percentile, ages 2-6; Table 2-4, EPA 1991 ____.

^b Mean of 50 percentile values for ages 6-18; Table 2-4, EPA 1991 ____.

^c Average adult (men and women); Table 2-3, EPA 1991 ____.

^d Based on teen total body and a percentage of adult total body.

^e Men only.

73. Commenting Organization: OEPA Commentor:
Pg. # 14 Section # 7.2.2.1 Paragraph # Sent./Line # 20-23
Original Comment # 69

Comment: Surface Area: This [sic] data is [sic] available in the EPA RAGS, 1989 document. According to the document hierarchy shown on page 13, information from the RAGS documents should be used for surface area.

Response: EPA's Risk Assessment Guidance for Superfund (RAGS) references EPA's Exposure Factors Handbook as the source of its surface area data. Section 7.2.2 lists the original reference document. The second bullet of the document hierarchy shown on page 13 refers to the 1989 RAGS document "...including suggested reference materials and services."

Action: The hierarchy will be clarified in Section 7.2.2, page 13.

74. Commenting Organization: OEPA Commentor:
Pg. # 15 Section # 7.2 Paragraph # Sent./Line # 21-22
Original Comment # 70

Comment: Mean value ingestion rates for children are not consistent with the RME approach. Upper-bound ingestion rate values should be used where available.

Response: Assuming that contact rate describes ingestion rate, the 95th percentile value should be used if statistical data are available for the ingestion rate. RAGS (1989) permits use of the 90th percentile value if the 95th percentile is not available. And if statistical data are not available, professional judgment should be used to estimate a value which approximates the 95th percentile value. (It is recognized that such estimates will not be precise. They should, however, reflect a reasonable estimate of an upper-bound value.) If mean values are all that are available, they will be used. In this case, neither the 95% upper confidence limit on the mean, nor the raw data necessary to calculate population statistics are available.

Action: No action is required.

75. Commenting Organization: OEPA Commentor:

Pg. # 20 Section # 7.2 Paragraph # Sent./Line # 30-34
Original Comment # 71

Comment: Skin permeability constants (PC) presented in the Superfund Exposure Assessment Manual (EPA 1988) have not been peer reviewed, and according to EPA (1989) guidance, should not be used in baseline risk assessments. In addition, the units presented in EPA (1988) and EPA (1989) are incorrect, as previously discussed (correct units: L/cm²/day). The PC for water (8.4 X 10⁴ [sic] L/cm²/day) should be used to evaluate the permeability of chemicals in water, unless a higher chemical-specific PC is available in the literature.

Response: EPA's "Interim Guidance for Dermal Exposure Assessment" (EPA/600/8-91/011A, March 1991) presents the same methodology used in the Human Health Evaluation Manual and the Superfund Exposure Assessment Manual with units of (cm/hr) for the permeability constant. This convention for expressing the permeability constant is also used in the peer reviewed technical literature. Perhaps a reference for the convention presented in the comment could be provided by Ohio EPA or U.S. EPA. Until such time the methodology presented in the Addendum will be used because it is consistent with all EPA guidance documents on the subject that we are aware of (EPA/600/8-91/011A, March 1991). In addition, the guidance letter from John Schaum (Schaum 1991) will be used as it applies. (See also Comment Nos. 69 and 213.)

Action: The text pertaining to skin permeability constants presented in Section 7.2.2.3 will be revised to state that the EPA guidance for dermal exposure assessment from John Schaum will be followed. This guidance will be summarized and presented in the text.

Add the following references to the Reference List:

"U.S. Environmental Protection Agency, 1991__, "Interim Guidance for Dermal Exposure Assessment," EPA/600/8-91/011A, EPA, Office of Research and Development, Washington, DC.

Schaum, J., U.S. Environmental Protection Agency, October 24, 1991 [Memorandum to Cindy Sonich-Mullin]"

76. Commenting Organization: OEPA Commentor:
Pg. # 28 Section # 7 Paragraph # Sent./Line # 7
Original Comment # 72

Comment: Provide a reference for equation (7-27) and for equation (7-31) on Page 30.

Response: Equation (7-27) is from Baes et al. 1984, which is included in the work plan reference list. Equation (7-31) is derived from basic radiological principles of dosimetry. The citation for equation (7-27) and the derivation of equation (7-31) will be included.

Action: In Section 7.4.1, page 28, line 6, add the parenthetical citation (Baes et al. 1984)
The following derivation of the constant 0.01867 will be added on page 30
immediately after the definitions of the terms in equation (7-31):

"The conversion factor 0.01867 is derived in the following manner:

$$0.01867 = (A)(B)(C)(D)(E)(F)(G)$$

where:

$$A = 1 \text{ Ci}/10^{12} \text{ pCi}$$

$$B = 3.7 \times 10^{10} \text{ disintegrations/Ci} \cdot \text{sec}$$

$$C = 3600 \text{ sec/hr}$$

$$D = 8760 \text{ hr/yr}$$

$$E = 10^6 \text{ eV/MeV}$$

$$F = 1.6 \times 10^{-12} \text{ erg/eV}$$

$$G = 1 \text{ rad} \cdot \text{g}/100 \text{ ergs.}$$

7. Commenting Organization: OEPA Commentor:
Pg. # 28 Section # 7.4.2.1 Paragraph # Sent./Line # 14-22
Original Comment # 73

Comment: DOE should consider the groundhog (*Marmota monax*) as a terrestrial indicator species. Groundhogs are likely to receive one of the greatest exposure [sic] to contaminants both under current and future scenarios. Groundhogs would be exposed both through the consumption of vegetation and the direct exposure to wastes, contaminated soils, and gamma radiation.

Response: Although it is true that groundhogs (*Marmota monax*) may reside near chemically and radioactively contaminated waste ponds (personal observation of L. Meyers-Schöne made at Oak Ridge National Laboratory, Oak Ridge, Tennessee), they were not selected as an indicator species for the FEMP. This decision was based on the low abundance of groundhogs on the FEMP (Facemire, C. F., S. I. Guttman, D. R. Osborne, and R. H. Sperger, 1990, "Biological and Ecological Site Characterization of the Feed Materials Production Center", FMPC-SUB 018, prepared for Westinghouse Materials Company of Ohio, Cincinnati, OH) and on the selection of the commonly found white-footed mouse, (*Peromyscus leucopus*) as an indicator species. Like the groundhog, the white-footed mouse is expected to be exposed to contaminants via consumption of vegetation and water, and by direct exposure to external radiation. The white-footed mouse may actually be exposed to higher levels of contaminants due to its omnivorous feeding habits. It was therefore felt that the white-footed mouse would serve as a more appropriate indicator species than the groundhog for the FEMP ecological risk assessment.

Action: No action is required.

78. Commenting Organization: OEPA Commentor:
Pg. # 28 Section # 7.4.2.1 Paragraph # Sent./Line # 21-22

Original Comment # 74

Comment: A total of nine radioactive and four HSL samples seems grossly inadequate to develop or verify any model for the exposure of terrestrial animals.

Response: The RI/FS mammal data are not intended to develop or verify a model for exposure of terrestrial animals to FEMP constituents. As stated in the text, these data will supplement modeling in the ecological assessment.

Action: No action is required.

79. **Commenting Organization:** OEPA **Commentor:**
Pg. # 29 **Section # 7.4.2.1** **Paragraph #** **Sent./Line # 5-7**
Original Comment # 75

Comment: The use of plant-to-beef transfer ratios for all herbivores requires additional justification and verification. Will this transfer ratio be used for the white-footed mouse? If so, DOE will need to collect verification samples to support this model.

Response: Plant to animal transfer ratios for metals and organic compounds are primarily limited to those available in the literature for the vegetation to beef pathway. These transfer ratios will be used both for the white-tailed deer and white-footed mouse. Because both cattle and deer are herbivores and ruminants, the use of the transfer ratios for cattle should be somewhat similar to those expected for deer. Plant to beef transfer ratios will be used as default values for the white-footed mouse due to the lack of mouse specific data in the open literature. Collection of verification samples to support the use of the transfer factors would require extensive sampling and analysis of approximately 80 chemicals of potential concern to ecological receptors. Uncertainties associated with the use of transfer factors are unlikely to be great enough to influence the ecological risk assessment sufficiently to affect selection of the preferred remedial alternative.

Action: No action is required.

80. **Commenting Organization:** OEPA **Commentor:**
Pg. # 29 **Section # 7.4.2.1** **Paragraph #** **Sent./Line # 11-18**
Original Comment # 76

Comment: The use of the muscle as the location of contaminants is unacceptable. Different contaminants have different receptor organs where contaminants accumulate. This is especially obvious for the radionuclides. DOE should discuss within the text the most likely receptor organs for the different contaminants of concern and provide justification for the use of muscle only.

Response: In the modeling of contaminants through ecological food webs, the red fox was assumed to ingest vegetation (fruits) and muscle tissue from white-footed mice. Muscle was not assumed to be the sole target organ for the contaminants of potential concern. It was, however, assumed to be the major tissue consumed by the

red fox. This assumption was made because of the availability of plant to muscle transfer factors for cattle muscle which will be used to model contaminants into the muscle of white-footed mice. It was therefore felt unnecessary to model contaminants into fat, liver, or calcified tissues. (See also Comment No. 81.)

Action: No action is required.

81. Commenting Organization: OEPA Commentor:
Pg. # 29 Section # 7.4.2.1 Paragraph # Sent./Line # 19-22
Original Comment # 77

Comment: The use of muscle for the sole source to carnivores is not well justified. Carnivores will consume more than just muscle. Consumption will include viscera and bones. It should be noted that rodents commonly consume the carrion bones and dropped deer antlers. If bones and antlers may be a receptor location for contaminants, these may be significant sources to small rodents.

Response: In the modeling of contaminants through ecological food webs, the red fox was assumed to ingest vegetation (fruits) and muscle tissue from white-footed mice. Muscle was not assumed to be the sole target organ for the contaminants of potential concern. It was, however, assumed to be the major tissue consumed by the red fox. This assumption was made because of the availability of plant to muscle transfer factors for cattle muscle which will be used to model contaminants into the muscle of white-footed mice. It was therefore felt unnecessary to model contaminants into fat, liver, or calcified tissues. (See also Comment No. 80.)

Action: No action is required.

82. Commenting Organization: OEPA Commentor:
Pg. # 29-30 Section # 7.4.2.1 Paragraph # Sent./Line # 30-32
Original Comment # 78

Comment: Soil ingestion along [sic] should not be used as the primary route of exposure for robins. Robins are known to consume large quantities of earthworms. Earthworms may uptake various contaminants from the soil as well as be affected by the toxicity of such contaminants. The USEPA guidance document "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference, 1989" discusses the use of earthworm toxicity tests. It is likely that a body of reference material is available on the uptake or [sic] organic contaminants by earthworms. Additional data may be available through DOE studies concerning the uptake of radionuclide [sic] by earthworms. If sufficient literature is not available concerning the uptake of site contaminants by earthworms, DOE should develop an investigation to provide this information.

Response: Soil ingestion was not assumed to be a route of exposure for robins. The route of exposure is consumption of earthworms living in soil. However, very few soil to earthworm transfer factors exist in the literature and those that exist do not consistently include information on purged and unpurged earthworms. Therefore, a

default value of one will be assumed for soil-to-earthworm transfer factors when applicable values cannot be found in the literature. The calculation is then as if robins were ingesting soil. The text will be modified to make this clear. Collection of samples to obtain estimates of contaminant uptake by earthworms would require the sampling of earthworms and soil from similar locations and the subsequent analysis of 80 chemicals of potential concern. This information is unlikely to influence the ecological risk assessment sufficiently to affect the selection of remediation goals.

Action: Change Section 7, page 29, line 30 and page 30, lines 1-2 to read:

"Ingestion of earthworms will be the primary route of exposure evaluated for the American robin. A default value of one will be assumed for the soil-to-earthworm transfer coefficient when applicable values cannot be found in the literature, due to the difficulty of estimating the uptake of constituents by earthworms and the lack of soil-to-earthworm transfer coefficients in the literature."

83. Commenting Organization: OEPA Commentor:
Pg. # 30 Section # 7.4.2.2 Paragraph # Sent./Line # 24-26
Original Comment # 79

Comment: Do the constants provided by Killough and McKay (1976) incorporate the exposure via contaminated sediments to organisms, such as the muskrat? The contribution of contaminated sediments to the exposure of aquatic organisms should be discussed in this paragraph.

Response: The constants presented in Table 7-4 are based on bioaccumulation factors for radionuclide uptake from water by aquatic organisms and on food chain uptake of radionuclides by a muskrat feeding on aquatic plants. Killough and McKay (1976) do provide constants for external radiation dose due to complete immersion in contaminated water, but the resulting doses are 1 to 2 orders of magnitude lower than internal doses and thus do not contribute significantly to total exposure. There is no reason to expect that doses from exposure to contaminated sediments would be higher than those from total immersion, particularly given the relatively low levels of radionuclides in Paddys Run and Great Miami River sediments. Killough and McKay's external dose factors for the radionuclides listed in Table 7-4 are provided below. The external dose constants of Killough and McKay are for all biota, rather than for separate levels of the food chain as in the case of internal factors.

<u>Radionuclide</u>	<u>External Dose (mrad/y) to Biota Exposed to 1.0 pCi/L</u>
Cesium-137	1.2×10^{-2}
Radium-226	2.5×10^{-4}
Strontium-90	1.0×10^{-2}
Thorium-228	8.0×10^{-2}
Thorium-230	1.7×10^{-4}
Uranium-234	1.6×10^{-4}
Uranium-235	5.4×10^{-3}

Uranium-236
Uranium-238

1.3×10^{-4}
 7.4×10^{-2}

Action: No action is required.

Commenting Organization: OEPA Commentor:
Pg. # 2 Section # 8.0 Paragraph # Sent./Line # 16
Original Comment # 80

Comment: PRP-derived Rfd's [sic] should be submitted for verification by ECAO prior to their use in a risk assessment.

Response: It is presently not clear which contaminants will need derived RfDs or CPFs. Schedules may not allow for presubmittal, but it is assumed ECAO will review values. If it is found that toxicity values must be developed, DOE will rely on ECAO for guidance. (See also Comment No. 13.)

Action: No action is required.

Commenting Organization: OEPA Commentor:
Pg. # 3 Section # 8.3 Paragraph # Sent./Line #
Original Comment # 81

Comment: Describe the methods used to derive the NOEC and LOEC values. How will ecological population impacts be evaluated using the NOEC and LOEC approach?

Response: In order to evaluate the toxicity of chemicals to terrestrial indicator species, chemical specific intake values will be compared to NOEC values. As a screening tool, NOEC and LOEC values presented in the IRIS database will be used for mammals. Uncertainty factors will be applied to the animal toxicity data in order to correct for differences between species, to modify LOEC values to NOEC values, and to adjust data obtained through short-term studies to that which would be expected in long-term studies. Literature obtained avian LD₅₀ values will be used for the robin and values adjusted with uncertainty factors to obtain an estimated NOEC. When avian toxicity data are not available, mammalian data will be substituted and appropriate uncertainty factors used. This will be made clear in the revised version of the work plan.

Population effects will be evaluated qualitatively based on the predicted effects of specific chemicals on individual animals."

Action: Following line 4, page 8-4, add:

"More specifically, the toxicity of chemicals to terrestrial species will be evaluated by comparisons of chemical-specific intake values to NOEC values. As a screening tool, NOEC and LOEC values presented in the IRIS database (EPA 1991a) will be used for mammals. Uncertainty factors will be applied to the animal toxicity data to correct for differences between species, to modify LOEC values to NOEC values,

and to adjust data obtained through short-term studies to those which would be expected in long-term studies. Literature obtained avian toxicity values will be used for the robin. LD₅₀ values will be adjusted with uncertainty factors to obtain an estimated NOEC. In the absence of avian toxicity data, available mammalian data will be substituted and appropriate uncertainty factors used. Uncertainty factors used to modify toxicity values will include:

- Short-term (<30 days, Newell et al. (1987) effect levels will be multiplied by 0.1 to estimate chronic, long-term effects.
- LOECs will be converted to NOECs by multiplying the effect concentration by 0.2 (Newell et al. 1987).
- LD₅₀ values will be converted to acute NOEC values by multiplying the effect concentration by 0.2.
- Interspecies adjustments will be made by multiplying the effect concentration by 0.1 (Newell et al. 1987). For species of different phylogenetic classes (mammal to bird), 0.05 will be used as the uncertainty factor."

When available, wildlife-specific dietary toxicity values will be compared to concentrations of specific constituents in the diet of the animal.

The following will be added to the list of references:

Newell, A.J., D.W. Johnson, and L.K. Allen, 1987, "Niagara River Biota Contamination Project: Fish Flesh Criteria for Piscivorous Wildlife," Technical Report 87-3, New York State Department for Environmental Conservation.

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| 86. | Commenting Organization: OEPA
Pg. # Section # 8.2
Original Comment # 82 | Commentor:
Paragraph #
Sent./Line # |
| | Comment: How will carcinogenic PAHs be evaluated in the baseline risk assessment? Will toxicity equivalency factors (TEFs) be used to estimate benzo(a)pyrene equivalents? | |
| | Response: At this time, PAHs with developed RfDs will be evaluated separately. Other PAHs will be assumed to equal the toxicity of B(a)P. Until U.S. EPA provides TEFs, DOE will not use them. | |
| | Action: Add to Section 8.2: "Polycyclic Aromatic Hydrocarbons for which no toxicity data are available will be evaluated using benzo(a)pyrene toxicity data". | |
| 87. | Commenting Organization: OEPA
Pg. # 3 Section # 8.2
Original Comment # 83 | Commentor:
Paragraph #
Sent./Line # 5 |
| | Comment: Define what constitutes an "environmentally significant isotope of uranium." | |

Response: The phrase refers to the isotopes of uranium originating from or found in natural uranium ore (i.e., U-234, U-235, and U-238). The text will be revised to clarify which isotopes of uranium are referenced.

Action: In Section 8.2, page 3, line 5 revise the sentence to read: "The uranium isotopes of concern (U-234, U-235, and U-238) are all alpha particle emitters."

3. **Commenting Organization:** OEPA **Commentor:**
Pg. # 1 **Section # 9.0** **Paragraph #** **Sent./Line # 10**
Original Comment # 84

Comment: Given the long time-frame required for remediation of the FEMP site, new guidance (e.g. RAGS Parts B and C) should be utilized as it becomes available. Also, please state how you intend to consider draft guidance.

Response: Copies of the December 1991 versions of RAGS Parts B and C are available and the methodology in these two guidance documents will be used. The issue involving incorporation of changes in EPA risk assessment guidance is not within the scope of this work plan and must be resolved by other means. (See also Comment Nos. 89 and 123.)

Action: In Section 9.0, page 1, delete the sentence in lines 13 and 14.

9. **Commenting Organization:** OEPA **Commentor:**
Pg. # 1 **Section # 9.0** **Paragraph #** **Sent./Line # 13-14**
Original Comment # 85

Comment: New guidance that is published prior to the ROD will have to be incorporated into decisions for remediation. DOE should consider how new guidance will be incorporated into decisions following the completion of the risk assessments. Is it DOE's intention to incorporate new guidance within a document during the revision/response to comments period? It is likely that a number of comments on the document will arise from new guidance which has been issued.

Response: Incorporation of new EPA guidance on risk assessment into decisions after completion of a risk assessment must be considered on a case specific basis and will depend on the impact of the new guidance on the results of the completed risk assessment. The issue involving incorporation of changes in EPA risk assessment guidance is not within the scope of this work plan and must be resolved by other means. (See also Comment Nos. 88 and 123).

Action: In Section 9.0, page 1, delete the sentence in lines 13 and 14.

10. **Commenting Organization:** OEPA **Commentor:**
Pg. # 3 **Section # 9.2** **Paragraph #** **Sent./Line # 24-25**
Original Comment # 86

Comment: If the Hazard Index (HI) exceeds unity, then the HI should be summed by target organ, as recommended in EPA (1989) guidance. (See also Comment No. 93.)

Response: DOE agrees with the comment.

Action: Add the following to the referenced section: "Since we are assuming dose additivity, hazard quotients for chemicals that affect the same target organ will be summed."

91. Commenting Organization: OEPA Commentor:
Pg. # 7 Section # 9.0 Paragraph # Sent./Line # 8-15
Original Comment # 87

Comment: DOE should incorporate the fish collection methodology currently employed by the Ohio EPA Fish Evaluation Group. Use of this methodology would allow for direct comparison to the extensive data base Ohio EPA has on stream/river fish communities within the state. Data collected under this methodology is readily incorporated in the Index of Biotic Integrity for community comparisons. Information on the Ohio EPA methodology is available from: OEPA, Division of Water Quality Monitoring and Assessment, 1800 WaterMark Drive, P.O. Box 1049, Columbus, Ohio 43266-0149. The document is titled: Biological Criteria for the Protection of Aquatic Life, Volumes I-III.

Response: DOE does not agree. It is inappropriate to incorporate sample collection methodology in this addendum, since its stated purpose is to present the risk assessment methodology which will be followed at the FEMP. The referenced text discusses studies of macroinvertebrates, not fish. These studies do incorporate OEPA methodology, as stated in the text.

Action: No action is required.

92. Commenting Organization: OEPA Commentor:
Pg. # 7 Section # 9.5 Paragraph # Sent./Line # 26
Original Comment # 88

Comment: Correct the typographical error where the phrase "both qualitative and quantitative evaluation of uncertainties" is repeated.

Response: DOE agrees with the comment.

Action: The typo will be corrected.

93. Commenting Organization: OEPA Commentor:
Pg. # 9 Section # Paragraph # Sent./Line # 1
Original Comment # 89

Comment: Hazard Indices greater than one should be split out according to critical effect.

Response: Individual HQs will be presented for all chemicals and all pathways. Individual HQs will be summed to determine the HI. (See Comment No. 90.)

Action: No action is required.

Commenting Organization: OEPA Commentor:
Pg. # Section # 10.0 Paragraph # Sent./Line #
Original Comment # 90

Comment: General Comment: This section appears to be outside the scope for a risk assessment work plan. Incorporating risk management issues into this work plan only clouds the issue of risk assessment methodology.

Response: Inclusion of Section 10.0 in the work plan addendum was agreed upon by EPA and DOE in order to present the methodology for risk management activities within the RI/FS for this large site consisting of multiple operable units, multiple contaminants, and multiple exposure pathways. DOE considers Section 10.0 to be an essential part of the overall description of methodology needing a priori concurrence by EPA to expedite approval of future deliverables.

Action: No text changes in the addendum are required.

5. Commenting Organization: OEPA Commentor:
Pg. # 3 Section # 10.1.1 Paragraph # Sent./Line # 17-25
Original Comment # 91

Comment: This paragraph fails to address the issue presented on the previous page concerning the ability of ARARs to be protective of human health and the environment in the presence of multiple contaminants and pathways. 40 CFR 300.430(e)(2)(i)(D) states "In cases involving multiple contaminants or pathways where attainment of chemical specific ARARs will result in cumulative risk in excess of 10^{-4} , criteria in paragraph (e)(2)(i)(A) of this section may also be considered when determining the cleanup level to be attained." The FEMP obviously has multiple pathways and multiple contaminants which result in a cumulative risk in excess of 10^{-4} .

Response: In developing PRGs, cumulative effects from multiple exposures to multiple pathways are accounted for by using a target risk level of 10^{-6} as one basis for media-specific, chemical-specific PRGs. In addition, the iterative nature of the FS Comprehensive Response Action Risk Evaluation (page 2-6 of the work plan) is designed to track the site's cumulative risk. This helps insure a site-wide cumulative risk will be below 10^{-4} .

Action: Section 10.0 is being revised to reflect new guidance from RAGS Part B.

6. Commenting Organization: OEPA Commentor:
Pg. # 3 Section # 10 Paragraph # Sent./Line # 27
Original Comment # 92

Comment: While it's true that some ARAR's are based on "technical limitations", some of these limitations are inherent to the media they are set for. For example, MCL's consider the limitations on municipal distribution systems. A compound may be readily treated (e.g. lead) but may be reintroduced through distribution. Therefore, strict occurrence [sic] with MCL's may not be appropriate for this site.

Response: Several comments (Nos. 96 through No. 98) address the use of ARARs and risk-based values for preliminary remediation goals. DOE's position on this issue appears to be in compliance with the new RAGS, Part B, in which the EPA proposes use of ARARs and risk-based values for preliminary remediation goals. Part B provides an example table that lists all preliminary remediation goals, such as ARARs (including MCLs) and risk-based goals. This is the manner that DOE plans to present PRGs. DOE plans to retain the discussion in Section 10.0 since the public needs to be aware of the fact that some PRGs may eventually be found to be unachievable.

Action: Provide an example table for PRG presentation in Section 10.1.1

97. **Commenting Organization:** OEPA **Commentor:**
Pg. # 3 **Section # 10** **Paragraph #** **Sent./Line # 29**
Original Comment # 93

Comment: By the same logic, if attainment of MCL's results in an exceedance of the allowable dose limit, remedial goals should be reevaluated to ensure compliance with the requirements of CERCLA.

Response: DOE is developing preliminary remediation goals in compliance with CERCLA. (See also Comment No. 92.)

Action: Add a discussion of new RAGS Part B to Section 10.0.

98. **Commenting Organization:** OEPA **Commentor:**
Pg. # 5 **Section # 10.1.2** **Paragraph #** **Sent./Line # 4**
Original Comment # 94

Comment: Change the third sentence to read "While preliminary remediation goals and final remediation goals will be risk-based, other factors will be considered in the development of the final [sic] goals."

Response: ARARs generally address health risk issues and thus even if ARARs are used for final goals, the final goals will be "risk-based".

Action: Change sentence to read (from RAGS Part B): "The two general sources of PRGs will be ARARs and risk-based goals. The PRGs will be modified based on the results of the baseline risk assessment. PRGs will be refined into final remediation levels based on risk, the balancing and modifying factors used in the remedy selection process, and other factors such as uncertainty, exposure and technical feasibility."

9. Commenting Organization: OEPA Commentor:
Pg. # 7 Section # 10.1.2 Paragraph # Sent./Line # 3-15
Original Comment # 95
- Comment: This paragraph attempts to compare "apples to oranges". The NCP discusses excess lifetime cancer risks while the calculations in this paragraph discuss the risk of cancer related deaths. Thus, neither set of assumptions presented in this paragraph meet the goal of the NCP. It is no surprise that the risk estimates are unequal. The paragraph should be deleted or reworded.
- Response: The example will be deleted.
- Action: In Section 10.1.2, page 7, lines 7-12 will be deleted.
00. Commenting Organization: OEPA Commentor:
Pg. # 7 Section # 10.1.2 Paragraph # Sent./Line # 16-19
Original Comment # 96
- Comment: This paragraph adds little to the section and should be deleted. Risk assessments have been and will continue to be used in determining absolute concentrations for cleanup.
- Response: RAGS Part B requires uncertainty analysis be included in the presentation of preliminary remediation goals. The uncertainties presented in this paragraph are standard risk assessment uncertainty that should accompany risk assessment calculations.
- Action: The example in the paragraph (lines 7-12) will be deleted. The remainder of the text will remain the same.
01. Commenting Organization: OEPA Commentor:
Pg. # 8 Section # 10.1.2 Paragraph # Sent./Line # 4-13
Original Comment # 97
- Comment: DOE's interpretation of the statement in this paragraph is unfounded and not applicable to the FEMP due to "extenuating circumstances such as exposure to multiple contaminants." The NCP is clear in its requirements for protection of human health and the environment and the attainment of the acceptable risk range.
- Response: Paragraph will be revised.
- Action: Delete sentence beginning "Despite the parenthetical...".
02. Commenting Organization: OEPA Commentor:
Pg. # 8 Section # 10.1.2 Paragraph # Sent./Line # 15-20
Original Comment # 98

Comment: DOE is drawing premature conclusions in this paragraph. The NCP requires that attainment of an acceptable risk range thus precedence is not needed [sic]. Cleanup should be to a level as close to the acceptable risk range as is technically feasible, not just to ARARs. If technology allows, cleanup must meet the acceptable risk range as defined in the NCP.

Response: CERCLA, along with other statutes, considers more than just technology, such as cost-benefit issues. Many ARARs reflect all of the considerations of past cleanup level debates.

Action: No action is required.

103. **Commenting Organization:** OEPA **Commentor:**
Pg. # 8 **Section # 10.1** **Paragraph #** **Sent./Line # 14-20**
Original Comment # 99

Comment: Absolute conclusions with regard to the selection of final remediation goals may be premature in this case given the potential for exposure to multiple chemicals of potential concern. It is recommended that health-based remediation goals should be presented along with ARARs in the FS in order that the regulatory agencies can select appropriate final remediation goals.

In addition, risk-contour plots also may be helpful in identifying areas that may require remediation at the site. Such an analysis would take into account the problems associated with exposure to a chemical mixture. For example, the total carcinogenic and noncarcinogenic risks associated with use of groundwater could be estimated for each sample location. These risks could be contoured using a kriging software package and displayed graphically. Areas that exceed a given target risk level (e.g., 10^{-4}) could easily be identified using such an approach.

Response: Health-based preliminary remediation goals will be presented in the FS.

Converting concentration data to risk isopleths at the FEMP using EPA risk assessment methodology has been under consideration by DOE for several months. The reviewer has accurately outlined the value of such a figure.

Action: No change in text required. A site map containing risk isopleths will be included in individual site-wide risk assessments where appropriate.

104. **Commenting Organization:** OEPA **Commentor:**
Pg. # 12 **Section # 10** **Paragraph #** **Sent./Line # 12**
Original Comment # 100

Comment: U.S. Department of Labor statistics are national averages which do not consider attempts made to minimize construction risks. Since the FEMP site has a well developed Health and Safety Plan, risk factors from the U.S. Department of Labor may overestimate construction risks. Information on construction risks at Superfund sites should be sought.

Response: Additional information will be sought. To date, the U.S. Department of Labor has not broken down construction risks for Superfund sites.

Action: No action is required.

105. **Commenting Organization:** OEPA **Commentor:**
Pg. # 14 **Section # 10** **Paragraph #** **Sent./Line # 13**
Original Comment # 101

Comment: Since much of the waste material requiring disposal will be considered low-level and a low-level waste repository may be sited in Ohio, the assumption of a 4440 mile trip for disposal seems high. Also, final disposition of these materials should be considered a one-way trip.

Response: The assumption of a low-level waste repository in Ohio is premature for the FS RAs. Keep in mind that if low-level waste has hazardous constituents, the final storage place must be able to accept mixed waste. Since a truck must return from the repository, and transportation risks are based solely on miles traveled, not on whether the truck is loaded, round trip mileage is used. One-way mileage is used for radiation exposure to the driver.

Action: No action required.

106. **Commenting Organization:** OEPA **Commentor:**
Pg. # 19-27 **Section # 10** **Paragraph #** **Sent./Line #**
Original Comment # 102

Comment: This sort of calculation is premature given that the alternatives haven't even been described yet.

Response: DOE is required to select preliminary leading remedial alternatives in the Site Characterization Report.

Action: Add text to indicate that early work on the optimization model is geared toward model development and output will be preliminary.

107. **Commenting Organization:** OEPA **Commentor:**
Pg. # **Section #** **Paragraph #** **Sent./Line #**
Original Comment # 103

Comment: **References:** A number of citations are out of alphabetical order. This section needs a good editorial review to make it more useful to the reader.

Response: DOE agrees with the comment.

Action: Order of references will be corrected. List of References will accordingly undergo an editorial review and will be revised.

U.S. EPA General Comments

108. Commenting Organization: U.S. EPA Commentor:

Pg. # Section # Paragraph # Sent./Line #
Original Comment # 1

Comment: The uncertainty discussions that recur in this document strongly indicate that this will be a theme in the final document. This is a delicate issue. If handled reasonably, the reader will understand the real limits of the estimates made. If handled inappropriately, the entire credibility of the document could be undermined.

Response: DOE agrees that the discussion of uncertainties in the Risk Assessment Work Plan Addendum, as well as the discussions in subsequent risk assessments, should describe the realistic limits of estimated risks in an unbiased manner. DOE recognizes that at each step of the risk assessment process, source term estimates, transport parameters, and exposure parameters are taken from their respective distributions of possible values so as to overestimate the source, transport, and exposure. The combination of estimated values (e.g., parameters) exceeding the mean or median value for each step of the risk assessment will cause the final risk estimate to exceed the mean or median of the estimated risk. In many cases this estimation will greatly exceed the "95 percent confidence level" for the calculated risk. Therefore, the overall uncertainty of the risk is such that risks exceed the estimated (reported) risk are much less likely than risks lower than the reported value. (See also Comment Nos. 119, 260, and 263.)

Action: Sections 9.5 and 10.1.2 will be revised to improve the explanation of sources and magnitudes of uncertainties that can lead to overestimation and underestimation of risks.

109. Commenting Organization: U.S. EPA Commentor:

Pg. # Section # 10.0 Paragraph # Sent./Line #
Original Comment # 2

Comment: Section 10 establishes quite definitely that the issue of ARAR based cleanup goals over risk based goals (10^{-4} to 10^{-6}) is favored by DOE. This fundamental issue should be resolved.

Response: This fundamental issue cannot be resolved in this work plan. In lieu of resolution, DOE will provide both ARAR and risk-based remediation goals in accordance with guidance from RAGS Part B.

Action: Section 10.0 will be revised to reflect RAGS Part B.

110. Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment # 3
- Comment: Specific and default parameters for all codes should be consistent.
- Response: The reviewer is referred to lines 19 and 20 on page 6-1 of the October, 1991 revision of the work plan addendum.
- Action: No changes in text required.
111. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # Section # Paragraph # Sent./Line #
Original Comment # 4
- Comment: The plan sets out the methodology for developing risk assessments for each of the operable units at the site. While the all-over approach is generally acceptable, the risk assessment work plan addendum fails to incorporate comments presented in the prior review of the draft work plan and deviates considerably from the methodology agreed to by DOE and EPA at the September 11, 1991 meeting in Chicago. These changes are not acceptable, and the previously discussed and agreed to methodology should be incorporated here.
- Response: DOE has prepared the work plan addendum in agreement with the methodology agreed to by DOE and EPA at the September 11, 1991 meeting in Chicago.
- Action: No specific text change is required in response to this comment.
112. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # Section # Paragraph # Sent./Line #
Original Comment # 5
- Comment: It should also be noted that the models have not been approved and will be examined at length to determine if they are appropriate and the assumptions and parameter values are reasonable for each OU at the site during the review of the individual OU risk assessments. Some assumptions and parameter values may need to be changed as the operable unit risk assessments are developed.
- Response: Approval of models. EPA first expressed concerns about the fate and transport models selected during a meeting with DOE on July 17, 1991. It was agreed at that meeting that DOE would provide descriptions, parameter values, and general information about those models to EPA for timely review as soon as possible. DOE faithfully supplied these models to EPA on August 1, 1991. The objective of this early submission was to provide the EPA with sufficient opportunity to approve or disapprove the general approach and review the specific fate and transport modeling codes proposed for use in the FEMP risk assessments. It was understood that this action would serve to expedite the evaluation process and allow compression of the schedule. During the past four months, the EPA has been actively commenting on

the models and parameter values by participating in two document review cycles (one informal and one formal). In view of this, DOE is disturbed by the statement that these models have yet to be examined in detail by EPA (after four months of EPA review). DOE would like to point out that this could result in unscheduled delays and adversely effect the public's confidence in the RI/FS process at the FEMP.

Changing assumptions/parameters. It is understood by DOE that risk assessment parameter values and site specific assumptions may change as more is learned about the site, and as EPA guidance evolves. It is also understood that the EPA must approve these changes. This understanding of the model/parameter selection process resulted in the early submittal of an internal draft of DOE's October, 1991 revision of the work plan addendum to the EPA two months before the document was formally submitted to the EPA. Informal comments on this draft were solicited, and the results of this informal review were incorporated in the October version of the work plan addendum formally submitted to the EPA. Because EPA guidance and values are still changing at a rapid rate, it is DOE's intent to continue this dialogue and obtain the earliest possible resolution of technical issues. (See also Comment No. 195.)

Action: Add text to Section 6.0 echoing the commitment, made by DOE in other portions of the Addendum, to follow available EPA guidance during the risk assessments at the FEMP. Also state that DOE understands that final approval of both models and parameters used in a specific risk assessment is dependent on their method of application in that risk assessment.

113. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # Section # Paragraph # Sent./Line #
Original Comment # 6

Comment: Included is a draft of RAGS, Part B, which should be helpful in preparation of the Preliminary Risk Assessment. It has been through sign-off and the printers. This is expected to be the distribution document. Consistency with this guidance is encouraged in the Preliminary RA.

Response: DOE has obtained an Interim version of RAGS Part B (December 1991).

Action: Guidance from RAGS Part B will be included in Section 10.0.

114. Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph # Sent./Line #
Original Comment # 7

Comment: In the Risk Assessment Work Plan, operable units (OU) are considered to be distinct. U.S. EPA (1989a) shows that risks from two OUs may need to be considered as a cumulative total if potential exists for exposure to both OUs. Not considering the risks resulting from exposure to contaminants from multiple OUs either by contaminant migration, receptor behavior, or direct overlap of OUs may

significantly underestimate risk associated with each OU as well as for the site as a whole. In the baseline and FS risk assessments as well as in the use of the site-wide optimization model, risks from exposure to multiple OUs should be considered.

Response: The risks resulting from exposure to contaminants from multiple operable units will be estimated in site-wide risk assessments, but not in baseline risk assessments for individual operable units. The first sentence in Section 2.3 concerning site-wide risk assessments states: "This group of assessments deals with those risks to human health and the environment which are associated with the FEMP as a whole." The implication is that site-wide risk assessments will address potential simultaneous combinations of exposure from multiple portions of the FEMP site. In addition, the sixth bullet in Section 2.3.1 (page 5, line 17) states that human health risks from multiple pathways and multiple contaminants to common receptors (receptors that are common to more than one pathway) will be combined. Section 9.3, page 5, line 22, states that the RME for the entire site from all exposure pathways will be assessed. Again, the implication is that this will include consideration of risks from exposure to contaminants from multiple operable units. Section 2.3.2, page 6, paragraph three addresses the FS Comprehensive Response Action Risk Evaluation and states that this assessment provides the mechanism to assess the cumulative impact of risks associated with each operable unit's remediation. The implication is that this will include consideration of risks from exposure to contaminants from multiple operable units. It should be noted that the first risk assessment deliverable, the Preliminary Site-Wide Baseline Risk Assessment, will consider the risks from exposures from multiple OUs and multiple pathways.

The optimization model is a tool that will provide a means for keeping track of projected operable unit residual risks with respect to each other and the site as a whole. This will determine if the total residual risk from the entire site is projected to comply with the site-wide risk constraint. Therefore, the optimization model includes consideration of risks from exposure to contaminants from multiple operable units.

Action: No text change is required.

15. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # **Section #** **Paragraph #** **Sent./Line #**
Original Comment # 8

Comment: At various points in the work plan, including the discussion of the site-wide optimization model in Section 10.0, it is unclear whether the OU risk being discussed is the sum of the risks from exposure to both chemicals and radionuclides of potential concern or whether these risks are being considered separately. This matter should be clarified throughout the work plan.

Response: DOE plans to present risks separately and combined. At the FEMP, it is likely that a single constituent, uranium, will dominate most of the exposures. In this case summing risks ($10^{-2} + 10^{-6} = 10^{-2}$) will not effect clean up decisions. In some

cases (e.g., the resident farmer scenario associated with OU1) where more constituents are present, this issue may be more important.

Action: No text change is required.

116. Commenting Organization: U.S. EPA Commentor:
Pg. # Section # Paragraph #
Original Comment # 9

Sent./Line #

Comment: Spot-checks of equations and parameter values were conducted throughout Sections 5.0, 6.3, 6.5, 7.0, and 10.0 when the references were available. The equations reviewed include 6-25, 6-26, 7-2, 7-3, 7-8, 7-14, 7-23, and 7-27. Parameter values reviewed include (1) the concentration ratios obtained from Baes et al [sic] 1984 listed in Section 7.0 on Page 20; (2) the specific activities of radionuclides listed in Section 7.0, on Page 21; and (3) the soil-to-plant and plant-to-plant-to-beef [sic] transfer coefficients for the radionuclides listed in Table 7-2. The equations and parameters checked are consistent with the references cited except for Equations 6-25, 6-26, and 7-14. The discrepancies are detailed below.

Equation 6-25 should read as follows:

$$J_t = (10^4) (R) (\rho) (E) [(\lambda) (D_t)]^{1/2} (\tanh [(X_t) (\lambda/DC_t)]^{1/2} [\text{sic}]$$

The denominator of Equation 6-26 should read as follows:

$$[1 + ((a_t/a_c)^{1/2}) (\tanh(b_t x_t))] + [1 - ((a_t/a_c)^{1/2}) (\tanh(b_t x_t))] e^{-2b_t x_c}$$

Equation 7-14 does not consider decay of the radionuclide over time that occurs from the time of consumption by the animal to the time of consumption of the animal product by a human. However, this may not be a factor if the radionuclides of concern have very long half-lives. Equation 7-14 should be revised to account for radionuclide decay.

Response: The equations presented in Comment No. 116 appear incomplete. The typos in the referenced work plan equations have been noted and will be corrected.

Action: The typographic errors will be corrected. The presentation of equations in the document will be reviewed.

117. Commenting Organization: U.S. EPA Commentor:
Pg. # 1 Section # 6.0 Paragraph #
Original Comment # 10

Sent./Line #

Comment: Throughout Section 6.0, references are made to an "EPA 70-year rule." The work plan should clarify the applicability of this "rule" to the FEMP site.

Response: This rule is part of the EPA exposure assessment methodology for evaluating long-term exposures at a site with groundwater pathways. See EPA's Superfund Exposure Assessment Manual for further details. The reviewer is also referred to the response to Comment No. 198.

Action: No action is required.

8. Commenting Organization: U.S. EPA Commentor:
Pg. # 22 Section # 7.3 Paragraph # Sent./Line #
Original Comment # 11

Comment: Section 7.3 states that the source geometries at the FEMP site preclude the use of U.S. EPA external gamma slope factors. Therefore, Microshield 3.0 will be used to calculate exposure rates from external sources at the FEMP site. The final risk assessment should include the input variables chosen to characterize exposures at the FEMP site and the rationale for their use. In addition, the discussion of uncertainties should include discussion of the chosen input variables and the effect of those choices on the risk assessment.

Response: It has always been the intent of DOE to provide this information as part of the documentation required when performing such calculations. Each risk assessment will include this documentation. Sections 3.4, 4.4, and 5.3 of the General Outline for a Baseline Risk Assessment Report (Attachment I of the October, 1991 revision of the work plan addendum) are the sections within each risk assessment where uncertainties associated with parameter values, and their impacts on the results of the individual risk assessments, will be discussed.

Action: Change Section 6.0 to explicitly state that input parameters for all models will be summarized in text or tabular form in each risk assessment report when they deviate from the values presented in the final revision of the work plan addendum.

19. Commenting Organization: U.S. EPA Commentor:
Pg. # 7 Section # 9.5 Paragraph # Sent./Line #
Original Comment # 12

Comment: Section 9.5 discusses uncertainties associated with the risk assessment. The text states that these uncertainties will be discussed in the context of how they may affect overestimation of risk at the site. Many factors associated with uncertainty can also contribute to underestimation of risk. Among these factors are the additivity assumption and the lack of toxicity values for all contaminants at a site. The discussion of uncertainties should be broadened to address these issues.

Response: DOE agrees that the discussion of uncertainties in the work plan addendum, as well as the discussions in subsequent risk assessments, should describe the realistic limits of estimated risks in an unbiased manner. DOE recognizes that at each step of the risk assessment process, source term estimates, transport parameters, and exposure parameters are taken from their respective distributions of possible values so as to overestimate the source, transport, and exposure. The combination of estimated values (e.g., parameters) exceeding the mean or median value for each step of the risk assessment will cause the final risk estimate to exceed the mean or median of the estimated risk. In many cases this estimation will greatly exceed the "95 percent confidence level" for the calculated risk. Therefore, the overall uncertainty of the risk is such that risks exceeding the estimated (reported) risk are much less likely

than risks lower than the reported value. (See also Comment Nos. 108, 260, and 263.)

Action: Sections 9.5 and 10.1.2 will be revised to improve the explanation of sources and magnitudes of uncertainties that can lead to overestimation and underestimation of risks.

120. Commenting Organization: U.S. EPA Commentor:
Pg. # 10 Section # 10.2.3.1 Paragraph # Sent./Line #
Original Comment # 13

Comment: Section 10.2.3.1 discusses risks to the public during remediation. Pathways discussed include transportation incidents and airborne releases. If the intent is to evaluate risks to the public during remediation, all risks to nearby residential populations evaluated in the baseline risk assessment should be addressed because all these risks will be present during the remediation process. However, if the intent is to evaluate risks to the public from the remediation process, the pathways listed in this section are adequate.

Response: All potential short-term risks that may occur during remediation (e.g. exposures from surface water run off) will be addressed either qualitatively or quantitatively in the FS risk assessments.

Action: More detail on short-term risks will be included in Section 10.0.

U.S. EPA Specific Comments

121. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # xv Section # Paragraph # Sent./Line # 20-24
Original Comment # 14

Comment: Definitions. Please correct the "Intake" definition as follows: For chemicals, it is expressed as the mass of a chemical in contact with the exchange boundary of a receptor... Intake refers to and is equivalent to the administered dose for chemicals. Inhalation, ingestion and dermal absorption are the three most important routes by which chemicals and radionuclides enter the body. The amount of a chemical entering the body by the dermal absorption route is referred to as the Absorbed Dose, or the mass of a chemical penetrating the exchange boundary of an organism after contact.

Response: The text will be revised to reflect the comment.

Action: In the List of Definitions, page xv, lines 20 - 24 revise the second sentence of the definition of INTAKE to read: "For chemicals, it is expressed as the mass of a chemical in contact with the exchange boundary of a receptor per unit body weight per unit time (e.g., mg chemical/kg body weight-day)."

122. Commenting Organization: U.S. EPA Commentor: 2799
Pg. # 8 Section # 1.7 Paragraph # Sent./Line #
Original Comment # 15

Comment: Figure 1-2. Delineating Operable Unit 3 would improve this figure. An additional figure, such as Figure 1-3 and 1-4, which designates the specific features of Operable Unit 3 would also improve the utility of this document.

Response: The nature of the definition of Operable Unit 3 does not lend itself to delineation in a figure without introducing the potential for confusion with the definitions of other operable units, especially Operable Unit 5. Operable Unit 3 includes a diverse list of facilities, structures, and stored materials, which are found at a number of dispersed locations. Depiction of these items in figures could best be accomplished using close-ups of limited areas of the FEMP. This level of detail is more appropriate for RI/FS documents specific to Operable Unit 3 rather than the work plan addendum, which addresses risk assessment methodology to be used in the RI/FS risk assessments.

Action: No text change is required.

123. Commenting Organization: U.S. EPA Commentor:
Pg. # 1 Section # 2.1 Paragraph # Sent./Line #
Original Comment # 16

Comment: Undoubtedly EPA guidance will be modified and expanded during the course of this assessment. A statement should be added about how the assessment procedures will adapt to significant new guidance, perhaps introduced within four months of the draft publication [sic].

Response: The issue involving incorporation of changes in EPA risk assessment guidance is not within the scope of this document and must be resolved by other means. (See also Comment Nos. 88 and 89.)

Action: No text change is required.

124. Commenting Organization: U.S. EPA Commentor:
Pg. # 4 Section # 2.2.1 Paragraph # 0 Sent./Line # 1-4
Original Comment # 17

Comment: The specific acceptable risk estimates that are considered protective of human health and that will be used as criteria in selection of a remedial alternative should be specified here.

Response: Preliminary remediation goals will be presented for 10^{-5} , and 10^{-6} , risks. These are in the range of an acceptable risk. This way, proper incremental cost risk benefit analysis may be performed. This information will be presented in Section 10.0 of the work plan addendum. (See also Comment No. 128.)

Action: Section 10.0 of the work plan will be revised to clarify this position.

125. Commenting Organization: U.S. EPA Commentor:
Pg. # 5 Section # 2.3.1 Paragraph # Sent./Line # 17-18
Original Comment # 18

Comment: Bullet 6. Results should not be presented solely as a total risk. It will be essential to see risk broken down by contaminant and pathway to the extent feasible.

Response: Results will be presented by contaminant and pathway to the extent feasible as well as a total risk. Section 9.3, page 5, lines 21 - 23 states that risk characterization results presented in each risk assessment report will include a tabulation of cancer risks and HIs associated with potential exposure pathways and the results will also be assessed for all exposure pathways from the entire site. The implication is that presentation will include results by contaminant and pathway to the extent feasible. (See also Comment Nos. 126 and 127.)

Action: In Section 2.3.1, page 5, lines 17-18, revise the bullet to read: "Quantify contaminant and pathway-specific risks and combine comparable human health risks from multiple pathways and multiple contaminants to common receptors."

126. Commenting Organization: U.S. EPA Commentor:
Pg. # 5 Section # 2.3.1 Paragraph # Sent./Line # 26
Original Comment # 19

Comment: Bullet 9. Risks should be broken down by radionuclide to the extent feasible so that major contributors by pathway, inhalation for example, can be established. This may not have to be for every single case, but should include enough examples to clearly delineate what are the significant contributors.

Response: In Section 2.3.1, page 5, line 26 (bullet 9) states that individual sources of risk contributing to the total risk for the site will be identified and quantified. The implication is that risks contributed by individual radionuclides will be presented. (See also Comment Nos. 125 and 127.)

Action: In Section 2.3.1, page 5, line 26, revise the bullet to read: "Identify and rank individual sources, contaminants, and pathways contributing to the total risk from the site."

127. Commenting Organization: U.S. EPA Commentor:
Pg. # 7 Section # 2.3.2 Paragraph # 2 Sent./Line # 3-6
Original Comment # 20

Comment: If the results are summed too much, then much of the specific information will be lost. Inclusive summations are acceptable so long as there is also more detailed information on the results that were summed.

Response: The FS risk assessments will be presented by contaminant and pathway to the extent feasible as well as a total risk. (See also Comment Nos. 125 and 126.)

Action: In Section 2.3.2, page 7, line 3, add the following sentence to the beginning of the paragraph that starts on line 3: "Contaminant and pathway-specific short-term and residual risks will be quantified for each operable unit Leaking Remedial Alternative."

128. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 8 **Section # 2.3.4** **Paragraph # 0** **Sent./Line # 3-11**
Original Comment # 21

Comment: See the comment for Section 2.2.1, Page 4, Paragraph 0. [Comment No. 124.]

Response: Preliminary remediation goals (PRG) will be presented for 10^{-5} , and 10^{-6} , risks. These are in the range of an acceptable risk. By presenting multiple PRGs, proper incremental cost risk benefit analysis may be performed. (See also Comment No. 124.)

Action: The work plan will be revised to clarify this position.

129. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 1 **Section # 3.0** **Paragraph #** **Sent./Line # 24+**
Original Comment # 22

Comment: The discussion on data use does not discuss how data will be handled if primary and secondary data (by the definition given) are conflicting and inconsistent. In most risk assessments, the consistency of primary and secondary data is evaluated and reported; any discrepancies [sic] are noted and explained. Inconsistency with secondary data may point out the need for further sampling.

Response: If primary and secondary data do not corroborate each other this will be noted and the primary data will be used for quantitative risk assessment calculations. As stated, secondary data will be used only in the absence of primary data.

Action: In Section 3.0, page 1, last paragraph, insert the following sentence immediately after the third sentence: "If primary and secondary data do not corroborate each other this will be noted in the uncertainty analyses and the primary data will be used for quantitative risk assessment calculations."

130. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 2 **Section # 3.1** **Paragraph #** **Sent./Line # 24-30**
Original Comment # 23

Comment: Second set of bullets. Within the RI/FS data base should be the Miami University study on stress identified among several wildlife populations on the FEMP property and the area residential data on groundwater and radon obtained by the Ohio Department of Health.

0079

Response: The second set of bullets in Section 3.1, page 2 addresses special studies conducted as part of the RI/FS. The Miami University study and the Ohio Department of Health study were not conducted as part of the RI/FS and is therefore, strictly speaking, not part of the RI/FS database. However, information in the Facemire study will be considered in the ecological assessment. The data obtained by the Ohio Department of Health will be presented and discussed in appropriate RI/FS Remedial Investigation/Risk Assessment reports.

Action: No text change is required.

131. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 5 Section # 3.3 [sic] Paragraph # 3 Sent./Line # 28-31
Original Comment # 24

Comment: Second bullet. The test [sic] should indicate whether the data sources are listed hierarchically. Also, in the final line under this bullet, "DOE-response" should be "dose-response."

Response: In Section 3.4, page 5, bullet beginning on line 28, the two EPA sources cited (IRIS and HEAST) will be used first. As stated on page 6, dose-response data from the open literature will only be used with the aid of EPA toxicologists if an EPA reference dose is not available in IRIS or HEAST. The phrase "DOE-response" will be changed to "Dose-response." (See also Comment Nos. 133 and 252.)

Action: In Section 3.4, page 5, revise line 31 to read: "Dose-response data from the open literature".

132. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 5 Section # 3.4 Paragraph # Sent./Line # 17-31
Original Comment # 25

Comment: Toxicity data on radionuclides could also be available from publications of the International Committee on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP).

Response: In Section 3.4 the primary objective is to identify sources of cancer slope factor and reference dose toxicity data that will be used to quantify human health risk/hazard. These are identified in Section 3.4. Additional contaminant-specific toxicity information will be included in individual risk assessments but not in the work plan addendum. Reports of the ICRP and NCRP will be used as sources of information and will be appropriately cited in the individual risk assessments when used in those risk assessments.

Action: No text change is required.

133. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 5 Section # 3.4 Paragraph # Sent./Line # 27-31
Original Comment # 26

Comment: For both carcinogens and noncarcinogens, the hierarchy of data sources includes a literature evaluation and recommendation by the Environmental Criteria Assessment Office (ECAO), Cincinnati. Use of DOE-response data from the literature is not acceptable unless it has been reviewed by ECAO.

Response: The data from the literature is not DOE-response data, but dose-response data from the scientific community. The reference to "DOE-response" in the work plan is a typographical error. We expect that RfDs or CSFs generated for the risk assessments will be sent to ECAO once EPA receives the reports. (Schedules will not allow for pre-submittal review). (See also Comment Nos. 13, 84, 131 and 252.)

Action: The typographical error will be corrected. In Section 3.4, page 5, revise line 31 to read: "Dose-response data from the open literature".

134. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 2 Section # 4.0 Paragraph # Sent./Line # 5-7
Original Comment # 27

Comment: The referenced methods for addressing ground water monitoring data are not appropriate for estimations of risk at Superfund sites for a variety of reasons. In addition, Region V has its own policy regarding ground water data (see enclosure). In general, the arithmetic mean, or adjusted arithmetic mean, concentration for background is compared with the mean concentration of the 1-3 wells that characterize the center of the plume of concern, using an appropriate statistical method such as the modified Students t-test. We recommend that this approach be followed at the FEMP; it will eliminate problems of differing MDLs. RAGS specifically advises against the use of detection limits (DLs) at any stage of the sample concentration calculation, and stresses instead the use of 1/2 the sample quantitation limit (SQL) for nondetects in all calculations.

Response: This comment appears to be inconsistent with the guidance provided by EPA Region V in the May 10, 1991 memorandum from John Kelly to Remedial and Enforcement Branch RPMs and Supervisors on the subject "Future Residential Land Use Ground Water Exposure Point Concentrations for the Baseline Risk Assessment." This memorandum does not state or imply that the "arithmetic mean, or adjusted mean concentration for background is compared with the mean concentration of the 1-3 wells that characterize the center of the plume of concern." There is also no mention in the memorandum of use of the modified Student's t-test (or other tests) for comparison of distribution of concentrations. (See also Comment Nos. 63, 217, and 219.)

DOE recognizes that EPA's Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) provides guidance regarding the

appropriate concentration to use for reported concentrations that are below sample quantification limits (SQLs). (See also Comment Nos. 140 and 144.)

Action: Section 4.0 will be revised to include the methodology specifically addressed in the memo from John Kelly dated May 10, 1991.

135. Commenting Organization: U.S. EPA Commentor:
Pg. # 1 Section # 4.1 Paragraph # Sent./Line # 6-12
Original Comment # 28

Comment: Bullet 1. Was the intent here to rule out use of data from gamma spectrometry which is not necessarily specific?

Response: In Section 4.1, page 1, lines 6-12 there is no intent to rule out the use of data from gamma spectrometry. Sample analytical results from gamma spectrometry will be used to perform quantitative risk assessment calculations because analysis by gamma spectrometry permits identification and quantification of specific radionuclide contaminants (something that field screening instruments can not provide).

Occasionally, complex gamma spectra arise during analysis of a sample containing numerous radionuclide contaminants, which preclude resolution and quantification of the peaks for some radionuclides. In these instances the gamma spectral analytical results can not be used for those radionuclides.

Action: No text change is required.

136. Commenting Organization: U.S. EPA Commentor:
Pg. # 1 Section # 4.1 Paragraph # Sent./Line # 25-26
Original Comment # 29

Comment: Bullet 5. It is unclear from this bullet what "J" qualifier data is or where it is to be found.

Response: The "J" qualifier is the most often encountered data qualifier in Superfund data packages. Under the Contract Laboratory Program (CLP), the "J" Qualifier describes an estimated value either for a tentatively identified compound or when a compound is present (spectral identification criteria are met, but the value is less than Contract Required Quantitation Limit (CRQL)).

Action: Revise bullet 5, page 1 to read: "Estimated quantitative results such as those identified by a "J" qualifier will be used in the risk assessment (EPA 1989a). The "J" qualifier is the most encountered data qualifier in Superfund data packages. Under the Contract Laboratory Program (CLP), the "J" qualifier describes an estimated value either for a tentatively identified compound or when a compound is present (spectral identification criteria are met), but the value is less than the Contract Required Quantitation Limit (CRQL)."

137. Commenting Organization: U.S. EPA Commentor:
Pg. # 2 Section # 4.2 Paragraph # 2
Original Comment # 30

Sent./Line # 5-7

Comment: The cited guidance (U.S. EPA, 1989b) states that tolerance intervals "can be applied with as few as three of the observations from the background distribution. However, doing so would result in [sic] a large upper tolerance limit. A sample size of eight or more results in an adequate tolerance interval." The cited guidance also discusses use of tolerance intervals for statistical analysis of groundwater at sites that "overlie extensive, homogenous geologic deposits that do not naturally display hydrogeochemical variation." It is not clear whether use of tolerance intervals is appropriate for groundwater at the FEMP site or whether use of tolerance interval is appropriate for soils and sediments that are likely to be far less homogeneous than groundwater. If tolerance intervals are used, at least eight background samples should be used to construct them.

Response: DOE agrees that use of as few as three background samples would likely result in the calculation of a large upper tolerance limit. If possible, at least twelve (12) background-concentration-values, with at least 50% of the data exceeding the SQL, will be used to establish the upper tolerance limit for each contaminant in each medium. If fewer than the desired number of background samples are available, non-parametric statistical methods will be used for comparison of site-related data to background data. The use of an upper tolerance limit for each contaminant in each medium is considered by DOE to be a reasonable, systematic approach for evaluating site-related data to background data. (See also Comment Nos. 12, 16, 17, 18, 19, 138, 150, and 153.)

Action: Section 4.2 will be revised to incorporate the methodology described in the response.

138. Commenting Organization: U.S. EPA Commentor:
Pg. # 2 Section # 4.2 Paragraph # 3
Original Comment # 31

Sent./Line # 8-14

Comment: Three sampling locations are too few to establish levels as critical as background. In the Uranium Mill Tailings Remedial Action Project in Grand Junction, Colorado, conducted by DOE, the inclusion protocol for contaminated vicinity properties contains the following statement,

"Background levels will be calculated from measurements made at a minimum of 30 representative locations within the region surrounding a designated processing site, taking into account any subregions where unusually high or low background levels may exist. Such measurements will not be made in the vicinity of known radioactive contamination. From these data, a mean background level and a standard deviation of the mean are calculated for use in establishing action levels for both indoor and outdoor on-site surveys within the region." ("Summary Protocol, UMTRAP Vicinity Properties, Identification-Characterization-Inclusion," U.S. DOE, September 1983)

Response: DOE agrees that three (3) samples are generally insufficient to establish background concentration distributions. DOE does not understand if EPA is recommending that the referenced methodology for determining background levels at uranium mill tailings sites be used for the RI/FS at the FEMP. The appropriateness and necessity for application of the referenced methodology in an RI/FS is questionable. (See also Comment Nos. 12, 16, 17, 18, 19, 137, 150, and 153.)

Action: DOE will revise Section 4.2 to indicate that at least twelve (12) background samples with at least 50% of the data exceeding the SQL, will be used to determine background concentration distributions for each contaminant in each medium. If fewer than the desired number of background samples are available, non-parametric statistical methods will be used for comparison of site-related data to background data. In the absence of knowledge of background concentrations, a concentration of zero will be assumed.

139. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 2 **Section # 4.2** **Paragraph # 6** **Sent./Line # 25-28**
Original Comment # 32

Comment: This process can not always be relied upon to identify outliers. For example, if the detection limit (MDL) for uranium in soil was 0.1 pCi/g (not uncommon), then data would be considered an outlier at any level above 1 pCi/g. 1 pCi/g is about background. Thus, the process would label anything above background an outlier.

Response: DOE agrees with the comment.

Action: The methodology noted in the comment will be removed and Section 4.2 will be revised to indicate the statistical methodology to be used for outliers.

140. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 3 **Section # 4.2** **Paragraph # 2** **Sent./Line # 9-18**
Original Comment # 33

Comment: The text should clarify whether the minimum detection limit (MDL) or one-half the MDL will be used in place of not detected (ND) sample concentrations to calculate the mean for a medium when a concentration greater than the detection limit is detected in at least one sample from that medium. It should also be noted that, in such situations, U.S. EPA (1989a) recommends use of one-half the sample quantitation limit (SQL).

Response: DOE generally agrees with the comment but recognizes that the comment is an unsupported simplification of guidance from Section 5.3 of the referenced EPA guidance document. The guidance allows for a great deal of latitude and professional judgement when determining the most appropriate method for treating non-detects. EPA Region V has specifically requested that a value of ½ SQL be used for non-detects. (See also Comment Nos. 134 and 144.)

Action: Sections 4.0 and 7.0 will be revised to indicate that a value of $\frac{1}{2}$ SQL will be used for non-detects.

141. Commenting Organization: U.S. EPA Commentor:
Pg. # 3 Section # 4.2 Paragraph # 2 Sent./Line # 9-18
Original Comment # 34

Comment: A basic question in this section is why the MDL changed. If analyses were done for radioactive materials, what was not constant, the background, the count time, the sample size, the counting geometry, or what? Does this indicate a faulty analytical protocol? The idea of "adjusting" the data to conform to a standardized MDL needs far more justification before it would deem [sic] acceptable.

Since there is a fundamental difference between the radiological definition of minimum detectable level and the chemical definition of minimum detectable level, does this paragraph represent a difference in semantics?

Response: Statistical terminology used in Section 4.0 will be reviewed. (See also Comment Nos. 134, 140, 144, and 155.)

Action: Section 4.2 will be revised to present the statistical terminology agreed upon by DOE, EPA, and Ohio EPA.

142. Commenting Organization: U.S. EPA Commentor:
Pg. # 3 Section # 4.3 Paragraph # Sent./Line #
Original Comment # 35

Comment: General comments. Why is so much effort spent in setting up criteria to eliminate data? Does this indicate a general distrust with the data collected?

Response: Section 4.3 does not indicate a general distrust with the data collected. Section 4.3 presents criteria to be used to determine the constituents of potential concern to be quantitatively evaluated in the risk assessment. Determination of the constituents of potential concern is a fundamental step in the risk assessment process presented in the Risk Assessment Guidance for Superfund (RAGS), Part A, Human Health Evaluation Manual. The criteria presented in Section 4.3 are generally obtained from RAGS, Part A. The RAGS approach employs criteria that help the risk assessor narrow the list of constituents of potential concern to focus on those that contribute the greatest risks. The criteria in RAGS appear in various portions of Chapter 5 of the RAGS Human Health Evaluation Manual. Exhibit 5-1 of RAGS Part A summarizes the approach to data evaluation culminating in determination of the constituents of potential concern for quantitative risk assessment.

Action: No text change is required.

143. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 5 Section # 4.3 Paragraph # Sent./Line # 5-7
Original Comment # 36

Comment: The 5% limit for exclusion as a Chemical of Concern (COC) is offered as an example in RAGS, not a rule. The use of frequency of detection limit for exclusion of chemicals is subject to approval by the project manager for the site, who may wave [sic] this rule or set a more stringent value (i.e., 1%). Highly toxic chemicals, including carcinogens, should never be excluded on the basis of a frequency of detection limit.

Response: The comment first states that the use of the criterion in question is subject to approval by the project manager for the site and then goes on to state that the criterion should never be used for highly toxic chemicals including carcinogens. The use of a frequency of detection criterion is intended as a generality not an absolute rule. It is considered to be a valid criterion that can be considered for risk assessments at Superfund sites. Nevertheless, this criterion will not be included in the revision of Section 4.3. (See also Comment No. 20.)

Action: Section 4.3 will be revised without inclusion of the "frequency of detection" criterion for identifying chemicals of potential concern.

144. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 3 Section # 4.3 Paragraph # Sent./Line # 11+
Original Comment # 37

Comment: As stated above, the use of DLs is contrary to RAGS guidance, which specifies the use of 1/2 the SQL for nondetects in the calculation of mean concentration values. See RAGS, section 5.3 for further explanation.

Response: DOE generally agrees with the comment but recognizes that the comment is an unsupported simplification of guidance from Section 5.3 of the referenced EPA guidance document. The guidance allows for a great deal of latitude and professional judgement when determining the most appropriate method for treating non-detects. EPA Region V has specifically requested that a value of 1/2 SQL be used for non-detects. (See also Comment Nos. 134 and 144.)

Action: Sections 4.0 and 7.0 will be revised to indicate that a value of 1/2 SQL will be used for non-detects.

145. Commenting Organization: U.S. EPA Commentor:
Pg. # 5 Section # 4.3 Paragraph # 2 Sent./Line # 3-7
Original Comment # 38

Comment: The elimination of radionuclides from analysis for a medium should not occur until it can be established conclusively that they were not there. Because of background levels, certain radionuclides like uranium, thorium and radium should be expected to be in all samples. If they weren't, then this might represent a lack of request for

this analysis or a faulty analysis. Moreover, for radionuclides it may be the case that a parent radionuclide was measured and its decay products can be assumed, without specific analysis (e.g., radium-226 producing radon-222). Further, some radionuclides tend to pair up and when one is measured the other is assumed to be there also (e.g., if uranium-238 is measured, then uranium-234 is assumed to be there in equal activity). The process advocated here is prone to significant errors.

Rejection of contaminant data when 5% or less of the analyses showed positive results could be very significant. If 1000 samples were analyzed, the data from fifty data points might establish an actual problem. By the proposed protocol these 50 points would be discarded. The process advocated here is prone to significant errors when the data base is large.

Response: The elimination of constituents from the list of potential concern for quantitative risk assessment for a medium includes consideration of comparison with background levels for naturally-occurring constituents. In the absence of a sample analytical result for a particular radionuclide in a medium, the assumption of radioactive equilibrium presented in the comment will be used, when appropriate, to estimate levels of specific radionuclides. The possible exceptions to criteria used for determination of constituents of potential concern necessitates that caution be used when applying such criteria, which should not be employed as absolute rules. In response to the specific example given in the comment (i.e., a large sample population with a 5% detection frequency) DOE would query the on LWG database for temporal and spatial information on the detects could be attributed to small localized zones of contamination. (See also Comment Nos. 142 and 143.)

Action: Section 4.3 will be revised to present the selection criteria for constituents of potential concern.

146. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 5 **Section # 4.3** **Paragraph #** **Sent./Line # 21-26 & 32-36**
Original Comment # 39

Comment: Bullets 2 and 4 seem to be contradictory. What statistical methods will be used for large sample populations?

Response: DOE agrees that Section 4.3 needs revision and clarification. (See also Comment Nos. 22, 148, 149, and 150.)

Action: Section 4.3 will be revised to describe the methodology for selection of constituents of potential concern for all sample populations.

147. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 5 **Section # 4.3** **Paragraph #** **Sent./Line # 13-20**
Original Comment # 40

Comment: Bullet 1. This bullet assumes that samples may be contaminated with laboratory chemicals. Has this been the case in analyses done to date?

Specifically, what common laboratory chemicals might also be process chemicals?

Does this process apply to radionuclides as well?

Response: Chapter 5 of the RAGS Human Health Evaluation Manual points out that some organic compounds (including acetone, 2-butanone, methylene chloride, toluene, and phthalate esters mentioned in Section 4.3, page 5, bullet 1) are considered by EPA to be common laboratory contaminants. Radionuclides are not specifically listed as common laboratory contaminants. Radioanalytical laboratory results are reviewed for suspect data. Such data are used for risk assessments unless data are revised by the laboratory.

Samples have been contaminated with laboratory chemicals in analyses done to date, which is common in environmental sampling efforts.

Action: No text change is required.

148. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 5 **Section # 4.3** **Paragraph #** **Sent./Line # 21-26**
Original Comment # 41

Comment: Bullet 2. A sample size of 8 is too few for creating a distribution. This advocated process is prone to great uncertainties.

Response: The number of values in a data set that are "sufficient" to determine the distribution type for the data set is not any fixed value. A greater number of values in a data set will almost always provide a better estimate of the distribution type. DOE proposes to use at least twelve (12) data values, with at least 50% of the values exceeding the SQL, as the desired number of data values to determine the distribution type. If fewer than the desired number of background samples are available, non-parametric statistical methods (that are independent of distribution type) will be used for comparing site-related data to background data. (See also Comment Nos. 22, 149, and 150.)

Action: Sections 4.0 and 7.0 will be revised to present the methodology for determining the distribution type for a data set and what methodology will be used when a distribution type cannot be determined.

149. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 5 **Section # 4.3** **Paragraph # 2** **Sent./Line # 21-26**
Original Comment # 42

Comment: Second bullet. If the sample population is large, a more reliable statistical comparison to background levels should be used, such as the Student's t-test discussed in the 4th bullet.

Response: The number of values in a data set that are "sufficient" to determine the distribution type for the data set is not any fixed value. A greater number of values in a data

set will almost always provide a better estimate of the distribution type. DOE proposes to use at least twelve (12) data values, with at least 50% of the values exceeding the SQL, as the desired number of data values to determine the distribution type. If fewer than the desired number of background samples are available, non-parametric statistical methods (that are independent of distribution type) will be used for comparing site-related data to background data. (See also Comment Nos. 22, 148, and 150.)

Action: Sections 4.0 and 7.0 will be revised to present the methodology for determining the distribution type for a data set and what methodology will be used when a distribution type cannot be determined.

150. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 5 **Section # 4.3** **Paragraph # 2** **Sent./Line # 27-31**
Original Comment # 43

Comment: Third bullet. Chemicals and radionuclides should not be considered naturally occurring and eliminated as chemicals of potential concern without a reliable estimate of background concentrations. If the sample population is extremely limited, and if a reliable statistical comparison to background levels cannot be performed, a chemical or radionuclide should be assumed to be site-related.

Response: DOE agrees that a reliable estimate of background concentrations should be made as part of the methodology for identifying the chemicals of potential concern. (See also Comment Nos. 22, 148, 149, and 150.)

Action: Section 4.3 will be revised to describe the methodology for selection of constituents of potential concern.

151. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 5 **Section # 4.3** **Paragraph #** **Sent./Line # 27-31**
Original Comment # 44

Comment: Bullet 3. The first question to answer is why there are too few samples? Unless there are prodigious constraints, teams should go out into the field and get the data required.

Does this process apply to radionuclides as well?

Response: The number of sample analyses that are available can be dependent on several considerations including constraints on the number of sample analyses for a particularly hazardous medium, constraints on the number of samples due to risks to workers or the public associated with obtaining samples, or the need for the sample analytical results compared to the impact of obtaining samples on the schedule for remediation. These types of constraints could apply to radionuclide or chemical constituents depending on the site. The schedules in the modified Consent Agreement are based on completion of the supplemental sampling and analysis plans agreed upon by DOE and EPA. Incorporation of additional sampling necessitates

additional addenda to the RI/FS work plan, which will require concurrence by EPA.
(See also Comment No. 192.)

Action: No text change is required.

152. Commenting Organization: U.S. EPA Commentor:
Pg. # 5 Section # 4.3 Paragraph # Sent./Line # 32-36
Original Comment # 45

Comment: Bullet 4. The level of significance is not specified.

Response: The revision of Section 4.0 and Section 7.0 will indicate that the upper tolerance limit (UTL) will correspond to the value of the upper 95% confidence limit on the 95th quantile of the background distribution. The upper 95% confidence limit ((UCL) on the arithmetic mean for either a normal or lognormal distribution will be used as the concentration value calculated for contaminant data.

Action: Sections 4.0 and 7.0 will be revised to agree with the response.

153. Commenting Organization: U.S. EPA Commentor:
Pg. # 5 Section # 4.3 Paragraph # 3 Sent./Line # 8-12
Original Comment # 46

Comment: Obtaining sufficient data for background determinations must be the first task. It is unacceptable to [sic] not to have a firm measure of background for at least all of the contaminants of concern.

What is the significance of the term "...sequential criteria"?

Response: The background data currently available for the site are obtained from a variety of sources of information depending on the medium of interest. Site-specific groundwater sample analytical results are available from RI/FS wells designated as background wells on the basis of their upgradient locations in the flow of the aquifer under the site. Site-specific surface water and sediment sample analytical results are available from RI/FS and WEMCO samples collected at locations in Paddys Run and the Great Miami River upgradient of the site. Regional surface soil sample analytical results for U-238, Th-232, and Ra-226 are available for the tri-state area from sample results appearing in a study in the peer reviewed literature. DOE is preparing a sampling and analysis plan to obtain sufficient site-specific data to characterize background in soil. DOE, EPA, and Ohio EPA will meet to discuss the methodology for evaluating background concentrations for the RI/FS at the FEMP. (See also Comment Nos. 12, 16, 17, 18, 19, 138, and 150.)

Action: Section 3.0 will be revised to indicate the sources of background data. Section 4.3 will be revised to describe the method for selection of constituents of potential concern. The use of "sequential criteria" will be removed from Section 4.3.

154. Commenting Organization: U.S. EPA Commentor:
Pg. # 6 Section # 4.3 Paragraph # 1
Original Comment # 47

Sent./Line # 1-5

Comment: U.S. EPA (1989b) recommends that concentrations detected in individual on-site samples be compared to the constructed tolerance limits; if a concentration detected in an on-site sample exceeds the upper tolerance limit, the contamination is shown to be site-related. Therefore, individual sample concentrations should be compared to the constructed tolerance limits and not to sample population means that may mask significant detected concentrations.

Response: DOE agrees that each sample concentration should be compared with the UTL, providing the UTL can be constructed. (See also Comment Nos. 17, 134, 137, 155, 217, 218, and 219.)

Action: Section 4.3 will be revised to indicate that individual sample concentrations will be compared to UTL values. Section 4.3 will also include the methodology to be used when UTL values cannot be constructed.

155. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 6 Section # 4.3 Paragraph #
Original Comment # 48

Sent./Line # 1-5

Comment: This approach is unacceptable for the reasons stated above in comments # 4 and 5 [134 and 144] - inappropriate statistical methods and lack of consistency with Region V ground water policy.

Response: DOE agrees that Section 4.3 needs revision to include appropriate statistical methods for identifying constituents of potential concern. (See also Comment Nos. 17, 134, 137, 154, 217, 218, and 219.)

Action: Section 4.3 will be revised to describe the methodology for selection of constituents of potential concern.

156. Commenting Organization: U.S. EPA Commentor:
Pg. # 6 Section # 4.3 Paragraph # 1
Original Comment # 49

Sent./Line # 4-5

Comment: This process could be prone to error since the site-related mean is a product of the number of samples taken away from hot spots. Good field sampling will identify hot spots, if they are present, even though they may be found only within small areas. In which case, the contaminants found in the hot spots should be listed as contaminants of concern. If much of the site is contaminant free, then the [sic] using a site-related mean will diminish the elevated data in hot spots and lead to a failure to identify contaminants [that] are really present.

Response: DOE agrees with the comment. (See also Comment No. 273.)

Action: Section 4.3 will be revised to present the methodology for identifying constituents of potential concern.

157. Commenting Organization: U.S. EPA Commentor:
Pg. # 6 Section # 4.3 Paragraph # 2 Sent./Line # 6-13
Original Comment # 50

Comment: The purpose of this exclusion is not clear. Were chemicals that are human nutrients used at the site? If so, there does not seem to be a sound basis for their elimination.

Will this process be applied to radionuclides as well?

Low concentration contaminants could still be significant. For example, in the case of the radionuclide actinium-227, it's high dose conversion factor makes its impact, even at low concentrations, significant.

It is far too vague to state that concentrations "...only slightly above background mean concentrations" will be eliminated. There should be a numerical criteria [sic].

Response: Determination of the constituents of potential concern is a fundamental step in the risk assessment process presented in the Risk Assessment Guidance for Superfund (RAGS) Part A, Human Health Evaluation Manual. The RAGS approach employs criteria that appear in various portions of Chapter 5 of the RAGS Human Health Evaluation Manual. In RAGS Part A, EPA recommends that essential human nutrients need not be considered in the quantitative risk assessment. Examples of essential human nutrients listed in RAGS include iron, magnesium, calcium, potassium, and sodium.

The criterion will not be applied to radioisotopes of these elements. However, it must be noted that radioisotopes of these elements are incorporated into the human physiology in the same manner as the stable forms of the elements, and radioisotopes of these elements occur in the environment from sources other than the FEMP site.

The criterion regarding constituents present at low concentrations (e.g. only slightly above naturally occurring levels) is one of those employed in Chapter 5 of the RAGS Human Health Evaluation Manual, which addresses data evaluation and determination of constituents of potential concern for quantitative risk assessment.

Action: Section 4.3 will be revised to present the methodology for identifying constituents of potential concern.

158. Commenting Organization: U.S. EPA Commentor:
Pg. # 6 Section # 4.3 Paragraph # 3 Sent./Line # 14-20
Original Comment # 51

Comment: For certain radionuclides, as noted above, the concentration is not the sole factor in the risk determination. The dose conversion factor is also important. To repeat the example, for actinium-227 the high dose conversion factor can make even low concentrations significant dosewise and riskwise.

Response: The concentration-toxicity screening criterion is included in accordance with the recommendations of RAGS, Part A, Human Health Evaluation Manual. As a concentration-toxicity screening procedure, it already includes consideration of health hazard/risk associated with the constituent in addition to the concentration of the constituent. The screening procedure is not solely dependent on concentration.

Action: Section 4.3 will be revised to explain more clearly the concentration-toxicity screening methodology.

159. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 6 **Section # 4.3** **Paragraph # 4** **Sent./Line # 21-31**
Original Comment # 52

Comment: ~~Pathway may also be a factor. For example, most of the inhalation risk could be a result of thorium-230 and actinium-227. Is it the intent of this process to eliminate uranium-238 and thorium-232 for inhalation calculations if they contribute less than 1% of the total inhalation dose (risk)? In addition, if a radionuclide is found to be significant in one pathway, will it be included in all other pathway calculations?~~

Response: The intent of the section is to present the criteria which may be considered when determining constituents of concern during FEMP Risk Assessments. It is not the intent of Section 4.3, page 6, paragraph 4 to specifically eliminate U-238 and Th-232 from inhalation exposure pathway calculations. The use of this particular criterion is intended as a generality, not an absolute rule. The same is true for any of the criteria presented in Section 4.3, because case-specific exceptions in individual risk assessments may arise subsequent to the approval of the addendum. The criteria will be used with caution so that substantial risks associated with the site are not overlooked.

If a constituent is found to be significant in one pathway it may or may not be significant in other pathways. However, in the risk assessment process presented in RAGS, determination of the list of constituents of potential concern occurs before potential exposure pathways are established or quantitatively evaluated. Therefore, if a constituent is determined to be of potential concern for quantitative risk assessment it is then considered for each exposure pathway. Section 5.0 discusses potential exposure pathways and selection of pathways to be quantified in the risk assessment.

Action: No text change is required.

160. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 7 **Section # 4.3** **Paragraph # 2** **Sent./Line # 4-7**
Original Comment # 53

- Comment:** Chemicals and radionuclides eliminated from the list of chemicals of potential concern because of low risk to human health should not necessarily be eliminated from the ecological assessment. Some chemicals or radionuclides may pose little threat to human health and yet pose a significant risk to other ecological [sic] receptors. A list of chemicals of potential concern should be prepared separately for the human health risk assessment and ecological assessment.
- Response:** Chemicals of potential concern will not be eliminated from the ecological assessment on the basis of low risk to human health. This will be clarified in the text.
- Action:** Revise the last paragraph of Section 4.3 to read: "All chemicals identified as chemicals of potential concern prior to screening for human health risk will be evaluated in the ecological assessment. Because ecological receptors currently have access to the FEMP site, no distinction will be made between present and future chemicals of potential concern, as will be the case in the human health risk assessment."

161. Commenting Organization: U.S. EPA Commentor:
Pg. # 8 Section # 4.4 Paragraph #
Original Comment # 54

Sent./Line #

Comment: Table 4-2. It is not entirely clear how to read this table. The precise ways in which "present" and "not present" labels were assigned needs to be specified. If no analysis was performed for a particular radionuclide would it be listed as not present? For example, since ores were once handled in OU3 why weren't actinium-227 and protactinium-231 found since they would be considered to be present in any uranium ore?

Response: Line 12 on page 4-7 describes how the labels were assigned. Constituents which have been detected by previous analyses were listed on this table. In addition, radioactive daughter nuclides with short half-lives are assumed to be present if their long-lived progenitor is listed in Table 4-2. Many chemicals and nuclides, such as protactinium-231 and actinium-227 have the potential to be constituents of concern for small portions of the production area, but data confirming their presence in measurable quantities is lacking at the present time. As stated in lines 13-16, page 4-7, efforts to identify additional constituents of concern within OU-3 are continuing.

Action: The word "present" will be changed to "detected or inferred" in Table 4-2.

162. Commenting Organization: U.S. EPA Commentor:
Pg. # 2 Section # 5.1.1.4 Paragraph # 4
Original Comment # 55

Sent./Line # 22-27

Comment: The distance from the site boundary to the nearest residence should be given.

Response: DOE agrees with the comment.

Action: In Section 5.1.1.4, paragraph 2 add the following to the end of the paragraph: "The nearest residences to the western FEMP property boundary (the boundary along the eastern side of Paddys Run Road) are located along the western side of Paddys Run road. The Knollman Dairy Farm is located on Willey Road just outside the southeast corner of the FEMP property boundary (leased grazing areas include areas inside the property boundary). Several residences are located off Paddys Run Road approximately one half mile south of the FEMP property boundary and along New Haven Road approximately one mile south of the FEMP property boundary. These residences are in the vicinity of the uranium South Plume, which extends south of the FEMP property boundary approximately three-quarters of a mile."

163. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 2 Section # 5.1.1.4 Paragraph # 5 Sent./Line # 28-33
Original Comment # 56

Comment: The text should indicate the proximity of the estimated population and of the nearest individual to the site boundary as to [sic] well as the plant center.

Response: In Section 5.1.1.4, the text presents a brief summary of proximal population demographics. The population estimate presented is within five miles of the center of the FEMP, as stated in the text. Distances to nearby municipalities are also included in the text. More detailed discussion of potentially exposed populations and critical subpopulations are included in Section 5.1.4 of the addendum. (See also the response to Comment No. 162.)

Action: In Section 5.1.1.4, paragraph 2 add the following to the end of the paragraph: "The nearest residences to the western FEMP property boundary (the boundary along the eastern side of Paddys Run Road) are located along the western side of Paddys Run road. The Knollman Dairy Farm is located on Willey Road just outside the southeast corner of the FEMP property boundary (leased grazing areas include areas inside the property boundary). Several residences are located off Paddys Run Road approximately one half mile south of the FEMP property boundary and along New Haven Road approximately one mile south of the FEMP property boundary. These residences are in the vicinity of the uranium South Plume, which extends south of the FEMP property boundary approximately three-quarters of a mile."

164. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 10 Section # 5.1.2 Paragraph # Sent./Line # 13-27
Original Comment # 57

Comment: A principal radiological constituent for the site has to include uranium-235 and its decay products. The original ores were chosen for their high total uranium content (which would include the uranium-235 series), actinium series decay products have been identified on the site, and some of the decay products may contribute to significant dose in certain pathways.

Response: The text in the October, 1991 revision of the work plan addendum is correct: "Principal radioactive constituents include, but are not limited to, unknown

quantities of thorium-232 and uranium-238 and their associated progeny." This text does not exclude U-235 and its decay chain from consideration, nor will this potential constituent of concern be overlooked. However, while it is true that the Inhalation Slope Factor of actinium-227 is approximately four (4) times greater than that of thorium-230 (for the most significant route of intake - inhalation), the thorium-230 to actinium-227 activity ratio in the K-65 silo contents is about 100 to 1. Since these residues are representative of residuals generated by uranium extraction processes throughout the site, risks from actinium-227 can be expected to be about 4% of the risks from thorium-230. Please see Bennett, B.G (1991) "Reply from UNSCEAR", Health Physics 61(6):919-920 for additional information on the topic.

Action: No text change is required.

165. Commenting Organization: U.S. EPA Commentor:
Pg. # 12 Section # 5.1.4 Paragraph # Sent./Line # 8-12
Original Comment # 58

Comment: The dairy farm at the edge of the FEMP site could be a source of potential impact upon the populace. It could certainly be a matter of public concern about drinking milk from this source. It is recommended that a subpopulation of milk drinkers for this site be included in the dose (risk) analysis if that was not the intent of bullet 4 on page 14 of Section 5.1.4.2.

Response: The fourth bullet refers to off-property dairy and meat users. See comment 171.

Action: The bullet on page 5-14, lines 18-20 will be changed to indicate the receptor can be the off-property user of dairy and beef products.

166. Commenting Organization: U.S. EPA Commentor:
Pg. # 13 Section # 5.1.4.1 Paragraph # 0 Sent./Line #
Original Comment # 59

Comment: The text should address any recreational facilities such as parks or swimming pools potentially affected by the site. Also, recreational uses of the Greater Miami River other than fishing, such as boating, water-skiing, and swimming, should be considered.

Response: The text in Section 5.1.4.1, page 13, fourth bullet includes mention of Whitewater Lake in Miami Whitewater Forest Park. Exposure scenarios that involve swimming will be added to the addendum. While fishermen and swimmers are potential critical subpopulations, risks to boaters and water-skiers are considered to be bounded by the swimming scenario, thus they are not considered critical subpopulations. Exposures to swimmers would be expected to represent an upper bound on potential exposures to boaters and water skiers. (See also Comment No. 64.)

Action: See the action for Comment No. 64 regarding the inclusion of exposure while swimming in contaminated water.

167. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 13-14 Section # 5.1.4.2 Paragraph # Sent./Line # 37+
Original Comment # 60

Comment: It appears that some exposed population groups have been lost in this new listing of "Exposures Assuming Current Access Controls Continue" and "Potential Exposures Assuming Current Access Controls Are Discontinued". At the September 11 meeting, it was allowed that the Current risk scenarios will be 2-tiered and will allow presentation of risks "assuming access controls" and "without access controls". This is a baseline risk assessment workplan. It assumes no action at the site and seeks to evaluate risks to all generations given no remediation at the site and no change in land use. Given the present state of the economy, it is important to document the underlying risks to all populations of interest should remediation be interrupted [sic]. The present strategy, assuming current land use of FEMP property will continue until remediation activities end, at which time active security controls will be discontinues [sic] is appropriate for the calculation of "with controls" scenarios. The "without controls" scenarios should incorporate the same populations in addition to the two listed on page 14, lines 29-41, but consider that the remediations do not take place and security becomes relaxed or unaffordable. Appropriate populations to be considered were presented and approved in the prior version (7/29/91) of this document in section 5.0, page 11. Omitted populations should be included in this version.

Response: The populations listed on page 5-11 of the August, 1991 revision of the work plan addendum were elaborated on and are presented in the October revision of the same document. It was not the intent of the text to exclude the exposure scenarios previously listed under the category "Potential Exposures Assuming Current Access Controls Continue" from consideration under the following category titled "Potential Exposures Assuming Current Access Controls Are Discontinued." The exposure scenarios under the second category were intended to supplement the four scenarios described in the former group. This confused several reviewers and will be clarified.

Action: Include the populations listed under "Potential Exposures Assuming Current Access Controls Continue" in the category titled "Potential Exposures Assuming Current Access Controls Are Discontinued." Include specific modifications to scenarios detailing effects of unlimited access to the site by these groups.

168. Commenting Organization: U.S. EPA Commentor:
Pg. # 14 Section # 5.1.4.2 Paragraph # Sent./Line # 1-20
Original Comment # 61

Comment: Section 5.1.4.1 states that 87 people live within 1 mile of the FEMP. Scenarios should be developed to deal with the risks to these people assuming current access controls continue and assuming current access controls are discontinued.

Response: It is the stated intent of DOE to identify and assess the risks to the RME individual using EPA guidance.

Action: Expand the list of exposure scenarios presented under "Potential Exposures Assuming Current Access Controls Are Discontinued." The reviewer is referred to the action listed under response to Comment No. 169.

169. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 14 Section # 5.1.4.2 Paragraph # Sent./Line # 29-36
Original Comment # 62

Comment: Bullet 5. In [the] farmland area within which the FEMP is sited, home gardens are expected to be the norm. A home garden should be included in this scenario, especially since lead-212 from the uranium-238 series could be a significant contributor.

Response: The risk from existing home gardens is incorporated into the off-property farmer scenario. The risks from consuming vegetables grown on-property must be investigated in the future scenario because there are currently no gardens on the FEMP property. This is true for any scenario requiring site development.

The reviewer should also note that Pb-212 is a decay product of the Th-232 decay chain, not the U-238 chain as stated.

Action: The exposures to be investigated under the future scenarios will be explicitly listed and described under the section entitled "Future Land-Use Scenarios".

170. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 13-15 Section # 5.1.4.2 & 5.1.4.3 Paragraph # Sent./Line #
Original Comment # 63

Comment: Present risk scenarios, both onsite and offsite, should include the K-65 silos. The silos presently do not have assured integrity and could be degraded further in the future.

Response: Present and future scenarios, both onsite and offsite, will include the K-65 silos. This is true for the site-wide risk assessments and the Operable Unit 4 risk assessments.

Action: No text change is required.

171. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 14 Section # 5.1.4.2 Paragraph # Sent./Line #
Original Comment # 64

Comment: Bullets. The "Visitor/trespasser" scenario is the regular visitor/ non-FEMP worker. The "Exploring child" [scenario] includes trespass scenarios inside the FEMP site. The exposures to the "Off-site farmer" should include exposure to the entire farm

family, including children who may accompany the farmer on-site and also trespass in Paddys Run. Who is the population receptor in the "On-site grazing" scenario - the farm family who consumes the dairy products? It is important to identify the Maximumly Exposed Individuals (MEIs) so that all applicable pathways may be summed to determine the RME risk.

Response: The Visitor/trespasser scenario also includes unauthorized adult trespassers.

The present system of access controls would limit children's access to areas of the property adjacent to the fence line. Based on current knowledge, Paddys Run presents the highest probability of exposure to measurable levels of contaminants and thus was selected as the location which might reasonably be expected to produce a measurable intake of site originated contaminants.

The list of exposures to the off-property farmer was not intended to be all inclusive. Indeed, this scenario is expected to be subject to location specific exposures, and may include any or all of the other scenarios as a subset of the larger farm family scenario.

DOE envisions the on-property grazing scenario to evaluate risks to off-property individuals using animal products from animals grazed on FEMP property. This includes both off-property farm families and off-property dairy/meat users. (See also Comment 165.)

Action: The visitor and trespasser scenarios will be presented separately. Examples of potentially exposed populations will be inserted in the senario descriptions presented in sections 5.1.4.2 and 5.1.4.3.

172. **Commenting Organization:** U.S. EPA **Commentor:**

Pg. # 14 [sic] Section # 5.1.4.2

Paragraph # 1

Sent./Line # 40+

Original Comment # 65

Comment: The sentence preceding the bulleted items should be revised to indicate that the following two populations are not the only populations exposed in the scenario but are in fact two additional exposed populations.

Response: Clarify types of receptors in the visitor/trespasser scenario.

Action: Include in Section 5.1 the populations listed under "Potential Exposures Assuming Current Access Controls Continue" in the category titled "Potential Exposures Assuming Current Access Controls Are Discontinued." Include in Section 5.1 specific modifications to scenarios detailing effects of unlimited access to the site by these groups.

173. **Commenting Organization:** U.S. EPA **Commentor:**

Pg. # 15 Section # 5.1.4.3

Paragraph # 3

Sent./Line # 11-22

Original Comment # 66

Comment: The text should clarify whether the farm family's exposure to dust includes exposure to particulates generated by wind erosion and farming operations.

Response: The text states that the farm family "inhales gases or dusts generated at the site". Thus, hypothetical receptors in this case are exposed to dusts generated by any activities on the site. Since these receptors are assumed to be located on property, this includes the resuspension of material by farm activities and wind erosion of site soils.

Action: Clarify this by inserting "as a result of natural or antropogenic activities." At the end of the sentence beginning on page 5-15, line 20.

174. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 15 Section # 5.1.4.3 Paragraph # Sent./Line # 11-26
Original Comment # 67

Comment: It is not clear from the discussion that the Future scenarios will address a change in land use given no action taken at the site (other than that which has been completed at the time of the preparation of the baseline risk assessment for that OU). Please clarify this point in this section.

Response: As stated in the text, the land use would revert to the predominant type of usage currently practiced in the surrounding area. The land use which predominates in the local area is agricultural (please see lines 14 and 15 on page 5-15). Hence the selection of the farm family as the representative hypothetical receptors. This scenario will be applied to both the no-action (baseline) case, and to evaluate the risks associated with residuals remaining after remediation.

Action: Text presenting the intention to apply this scenario to both the no-action and remedial action evaluations will be inserted in Section 5.1.4.3.

175. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 15 Section # 5.1.4.4 Paragraph # Sent./Line # 27+
Original Comment # 68

Comment: It is not clear to which scenarios the Occupational Receptors belong. Please clarify in the opening paragraph that Occupational Receptors are being identified here for the FS alternatives risk assessments. A more appropriate heading would be Scenarios for Evaluating FS Alternatives. Lines 4-10 on this page also belong to this section.

Response: This section confused a couple of reviewers and will be clarified. Please note that one of the receptors identified (the visitor) will be evaluated in the baseline risk assessment, not just in the FS as implied by the comment.

Action: Section 5.1.4.3 and accompanying Table 5-2 will be revised to clarify the meaning of "occupational receptors".

176. Commenting Organization: U.S. EPA Commentor:
Pg. # 17 Section # 5.1.4.4 Paragraph # 5
Original Comment # 69

Sent./Line # 24-30

Comment: Since delivery workers are regular site visitors, there should be a quantitative evaluation of their potential exposure. This could provide information for the worker or for the general public to answer this inevitable question.

Response: Delivery workers should be treated no differently than any other type of potential receptor. Hypothetical risks to this group of potentially exposed individuals will first be qualitatively evaluated. If significant plausible exposure scenarios exist, they will be quantified. See comment nos. 171, 175.

Action: No text change is required.

177. Commenting Organization: U.S. EPA Commentor:
Pg. # 20 Section # 5.2.1 Paragraph # 2
Original Comment # 70

Sent./Line # 13-15

Comment: This paragraph should discuss the potential for contaminant migration via deposition of airborne particulates into surface water bodies.

Response: A large number of pathways were considered during the preparation of Table 5-3. Many were not included because they were considered to be either insignificant or incomplete. Aerial resuspension, transport, and subsequent deposition into water bodies was one such pathway. This environmental transport pathway is postulated to be a significant contributor to pollution in the Great Lakes. Upon close examination, the rate of loading to a unit surface area of a water body by this pathway is small. (For Lake Ontario, it is typically on the order of $\mu\text{g}/\text{d}/\text{m}^2$.) However, because the Great Lakes have a large surface area measured in square miles, and a retention time measured in years, significant surface loading to the system can result. For example, Lake Ontario has a surface area of 19,000 km^2 , and a system residence time of 7.8 years.* There are no comparable water bodies (i.e. large surface areas and very low flow to volume ratios) at the FEMP. Therefore, the ratio of total mass loading to a given volume of water flowing through the local surface water systems will be extremely limited, especially compared with other sources of mass loading to those systems. Direct contribution by runoff and the resulting surface soil erosion were judged to be much greater contributors to mass loading of the local surface water systems. For this reason, aerial deposition to surface water bodies was considered insignificant for this series of assessments. In addition, current information on contaminant concentration in sediment and Great Miami River water indicate that exposures from these media are currently small.

* Physical dimensions of Lake Ontario from Chapra, S.C., 1980, "Simulation of Recent and Projected Total Phosphorus Trends in Lake Ontario" J. Great Lakes Res., 6(2):101-112.

Action: No text change is required.

178. Commenting Organization: U.S. EPA Commentor:
Pg. # 21 Section # 5.2.1 Paragraph # 1
Original Comment # 71

Sent./Line # 10-22

Comment: The question may be asked about the release of radon from groundwater within homes. Is it the intent of these calculations to include this pathway?

Response: Yes.

Action: Clarify the text to state that the pathway does include radon from water use inside homes.

179. Commenting Organization: U.S. EPA Commentor:
Pg. # 21 Section # 5.2.2 Paragraph #
Original Comment # 72

Sent./Line # 10-28

Comment: There is a need to define the potential for risks from other isotopes of radon, namely radon-220 (thoron) and radon-219 (actinon). In Table 4-2, radon-220 is listed as found in OU3 and radium-224, thoron's parent, is listed as found in OU4. In former buildings associated with Futura Coatings site in St. Louis, actinon was found by both Oak Ridge National Laboratory and Argonne National Laboratory, at levels on the order of 80% of the total radon concentration. The St. Louis site is part of the larger site associated with the former uranium extraction operations at the Mallinckrodt Chemical Company. It is believed that Mallinckrodt wastes, which are similar to FEMP radiological wastes, were shipped from St. Louis to the FMPC in the past.

Response: Rn-220 and Rn-219 may potentially be of concern in air in buildings that contain the parent radionuclides. However, these isotopes of radon are not expected to be released from the K-65 silos because their short half-lives would cause them to decay before migrating out of the waste matrix or out of the silos.

Action: In Section 5.2.2, page 21, first paragraph, add the following to the end of the paragraph: "Airborne isotopes of radon (Rn-222, Rn-220, Rn-219) may pose a potential risk in buildings at the site, especially in buildings that are contaminated with parent radionuclides of radon or in buildings used to store drums of material that contain the parent radionuclides. Risks from radon and its daughters will be assessed if parent radionuclides of radon are present or suspected."

180. Commenting Organization: U.S. EPA Commentor:
Pg. # 16 Section # 5.1.4.4 Paragraph #
Original Comment # 73

Sent./Line #

Comment: Table 5-2. The use of N and Y here is not clear. Does it mean no radiation exposure and yes radiation exposure, respectively? If so, how can a remediation worker not get a radiation exposure when working amongst radioactive materials?

Response: This section confused a couple of reviewers and will be clarified. Please note that one of the receptors identified (the visitor) will be evaluated in the baseline risk assessment, not just in the FS as implied by the comment.

Action: Section 5.1.4.3 and accompanying Table 5-2 will be revised to clarify the assumptions for potential receptors. (See also Comment No. 175).

181. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 22 **Section # 5.2.4** **Paragraph # 3** **Sent./Line # 11-17**
Original Comment # 74

Comment: The site characterization should clarify whether surface water bodies located on site contain water all year or whether they dry out in summer. If a surface water body dries out in summer, then it is reasonable to consider exposure to sediments associated with that surface water body to be similar to exposure to surface soils during the dry period(s).

Response: Paddys Run and the Storm Sewer Outfall Ditch dry out in the summer. Exposure to sediments is considered a potential pathway whether the surface water bodies contain water all year or not. The methodology for calculating exposure to sediments is presented in Section 7.2.1, and is the same as for soils. The methodology is obtained from RAGS.

Action: No text change is required.

182. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 23 **Section # 5.3** **Paragraph # 1** **Sent./Line # 3-4**
Original Comment # 75

Comment: The first sentence should be revised to indicate that an exposure pathway will also be selected for detailed evaluation if the pathway is potentially complete, as in a future land use scenario.

Response: DOE agrees with the comment. (See also Comment No. 190.)

Action: Insert text in Section 5.3 which specifically includes future pathways.

183. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 23 **Section # 5.3** **Paragraph #** **Sent./Line # 3-4**
Original Comment # 76

Comment: From "An exposure pathway.." to ".. receptor is exposed)". It's hard to imagine reasonable pathways that wouldn't de facto fit these four criteria. It is also possible to imagine unreasonable pathways that would fit these four criteria, specifically, a person swimming in a cave in an pool fed by contaminated groundwater. Unless a strong justification can be offered, it is suggested that the pathway elimination mechanism be dropped since it is unable to adequately discriminate reasonable from unreasonable pathways.

Response: DOE strongly disagrees. These criteria are based on information contained in Section 6.3 of the EPA's Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A. Their purpose is to provide insight into the methodology that will be used to select pathways for evaluation. The commenter's first sentence indicates that reasonable pathways satisfy these criteria. These criteria can be used to identify unreasonable pathways, such as the reviewers' example. The third criteria, listed on line 7 of page 5-23, requires a receptor to be present at the exposure location. The FEMP is located on glacial till, and there are no underground caves for receptors to swim in at the FEMP. Thus the proposed pathway is considered unreasonable, subject to EPA concurrence.

Action: No text change is required.

184. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 24-25 **Section #** 5.3 **Paragraph #** **Sent./Line #**
Original Comment # 77

Comment: Table 5.3 [sic]. For id 5 and 6, Surface soil, why is the 1b pathway omitted for some OUs? Given no access controls, all OUs could be accessible to trespass. In the groundwater pathway, id 24, inhalation and dermal absorption of chemicals in domestic groundwater are missing. Use of domestic groundwater should include exposure to chemicals in this medium by all three pathways. For id 34 and 35, sediment, the logic for including these pathways in all OUs is the same as stated above for Surface soil.

Response: The reviewer has apparently misread the table. The footnotes at the bottom of the page describe the identification numbers at the top of the column. The "1" identifier denotes exposures which are possible under the current situation, assuming access controls are in place. The "2" identifier denotes hypothetical exposures which would be possible under the current situation assuming no access controls existed. Thus for pathways 5 and 6, the table clearly indicates that the soil pathways would be considered.

The reviewer is referred to pathway 25, not 24 for these pathways in existing groundwater supplies. See also pathway 10 for future groundwater contamination.

Sediment pathways 34 and 35 are included in all Operable units containing sediment. Operable Unit 3, as it is currently configured, does not contain sediments. Sediment pathways 8 and 11 are included in all OUs to reflect the potential for erosion of existing operable unit source areas to create new sediment.

Action: No changes in the text are proposed in response to this comment, however this table and its accompanying text have been revised in response to other comments.

185. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 27 **Section #** 5.3.1 **Paragraph #** **Sent./Line #**
Original Comment # 78

Comment: Explanation of exposure pathways should match the id numbers in Table 5.3 - i.e., # 7 (Direct ingestion of soil/waste) should match # 7 in the table, etc. Number 33 should also include ingestion of contaminated sediments along with surface water - i.e., cattle drinking or foraging in Paddys Run.

Response: The descriptions of pathways 6 and 7 are switched in the text. Cattle ingesting soils and sediments while foraging in Paddys Run are included in Pathway 17. Cattle drinking from Paddys Run are included in Pathway 33.

Action: The pathway descriptions will be renumbered in Section 5.1.4.2.

186. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 27 **Section # 5.3.1** **Paragraph # 1** **Sent./Line # 1-5**
Original Comment # 79

Comment: Incidental ingestion of surface water during recreational use should be added to the group of pathways and to Table 5-3. Similarly, soil gas migration into residences should be considered in the future land use scenario and possibly in the current land use scenario, depending on the proximity of the nearest receptor and on the concentrations of contaminants identified in soil gas. This pathway presents the potential for significant exposure, especially to radionuclides that have a gas phase decay product.

Response: A large number of pathways were considered during the preparation of Table 5-3. Many were not included because they were considered to either be insignificant or incomplete. Direct ingestion of surface water while swimming was one such pathway. Although it is unlikely that the Great Miami River in the vicinity of the FEMP is used for activities such as swimming, the risks from this pathway were compared with the risks from the drinking water pathway. First, it was assumed that water concentrations used in the drinking water pathway assessment will be the reasonable maximum concentrations of contaminants available to the potential receptor. Thus, contaminant concentrations in drinking water will be equal to or greater than contaminant concentrations in water available for swimming. The drinking water pathway postulated at the FEMP involves the consumption of 51,100 liters of untreated water per lifetime (70 years). The swimming pathway listed in Exhibit 6-12 of the EPA's Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A involves the consumption of 0.05 L/hour for 8 hours a day^a for 7 days a year over 30 years. This yields a total intake of 84 liters during a lifetime of swimming. If the concentrations in drinking water sources are equivalent to the water used for recreation, the swimming pathway can be expected to contribute less than 0.2% of the risk from the drinking water pathway. For this reason, the pathway was not included on the table; however, Table 5-3 will be revised to include the pathway. As stated in the text, this list of selected pathways will be reviewed for accuracy and completeness during each RI/FS risk assessment. (See Comment No. 34, 64, and 188).

Exposures to radon and other gases in homes via soil gas migration is included in Section 5.3 as part of pathway number 12 (clarification will be added to the text). (See also Comment No. 188.)

^a Conservative assumption.

Incidental ingestion pathways to Table 5-3 and accompanying text. See Action under Comment 64.

Action: In Section 5.3, page 28, lines 9 to 11 revise the text to read: Inhalation of gases emitted from soil/waste. This pathway postulates the emission of gases such as radon and volatile organic vapors from soil/waste. This is followed by their transportation through the soil and air to the vicinity of the receptor (either indoors or outdoors). The receptor then inhales these gases. The pathway will be analyzed for both current and future scenarios.

187. Commenting Organization: U.S. EPA Commentor:
Pg. # 30 Section # 5.3.3 Paragraph # 0 Sent./Line # 9-11
Original Comment # 80

Comment: Item No. 25. The text should clarify which routes will be considered in the evaluation of exposure resulting from use of potable domestic water.

Response: DOE agrees with the comment. Use of existing groundwater as potable domestic water may include dermal contact while bathing and inhalation of volatiles due to household water use and showering.

Action: This pathway postulates the migration and subsequent use of existing contaminated groundwater as domestic (non-drinking) water. Shower and dermal contact while bathing are routes that will be considered in the evaluation of exposure.

188. Commenting Organization: U.S. EPA Commentor:
Pg. # 30 Section # 5.3.4 Paragraph # 1 Sent./Line # 22-31
Original Comment # 81

Comment: See the comment for Section 5.3.1, Page 27, Paragraph 1.

Response: A large number of pathways were considered during the preparation of Table 5-3. Many were not included because they were considered to either be insignificant or incomplete. Direct ingestion of surface water while swimming was one such pathway. Although it is unlikely that the Great Miami River in the vicinity of the FEMP is used for activities such as swimming, the risks from this pathway were compared with the risks from the drinking water pathway. First, it was assumed that water concentrations used in the drinking water pathway assessment will be the reasonable maximum concentrations of contaminants available to the potential receptor. Thus, contaminant concentrations in drinking water will be equal to or greater than contaminant concentrations in water available for swimming. The drinking water pathway postulated at the FEMP involves the consumption of 51,100

liters of untreated water per lifetime (70 years). The swimming pathway listed in Exhibit 6-12 of the EPA's Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A involves the consumption of 0.05 L/hour for 8 hours a day^a for 7 days a year over 30 years. This yields a total intake of 84 liters during a lifetime of swimming. If the concentrations in drinking water sources are equivalent to the water used for recreation, the swimming pathway can be expected to contribute less than 0.2% of the risk from the drinking water pathway. For this reason, the pathway was not included on the table; however, Table 5-3 will be revised to include the pathway. As stated in the text, this list of selected pathways will be reviewed for accuracy and completeness during each RI/FS risk assessment. (See Comment No. 34, 64 and 186.)

^a Conservative assumption.

Action: In Section 5.3, page 28, lines 9 to 11 revise the text to read: Inhalation of gases emitted from soil/waste. This pathway postulates the emission of gases such as radon and volatile organic vapors from soil/waste. This is followed by their transportation through the soil and air to the vicinity of the receptor (either indoors or outdoors). The receptor then inhales these gases. The pathway will be analyzed for both current and future scenarios.

189. Commenting Organization: U.S. EPA Commentor:

Pg. # 31 Section # 5.4 Paragraph # Sent./Line #
Original Comment # 82

Comment: Justification needs to be provided for not assuming that a person can be exposed under more than one scenario? [sic] Could a person live within 1 mile of the site and also work or visit the site?

It [sic] in addition to concentration, the dose conversion factor for radionuclides is very important. For example the inhalation dose conversion factor for actinium-227 is 150 to 780 times that for radium-226. Therefore, small concentrations of actinium-227 might be more significant than larger concentrations of radium-226.

Response: The assumption that a receptor is exposed to only one scenario has not been made in this section or anywhere else in the October, 1991 revision of the work plan addendum. The specific example presented in the comment would be handled by evaluating and presenting the risks from two pathways (which are not mutually exclusive) separately. They can be combined at a later time. If they are added prematurely, information about the individual assessments could be lost.

The relative toxicity of a constituent of concern does impact the selection of the RME location. To specifically address the actinium question, DOE would like to point out that thorium-230 risks are expected to dominate actinium-227 risks for the most critical pathway. (See also the response to Comment No. 164.)

Action: Insert "and toxicity" after "concentration" in line 35 on page 5-31.

190. Commenting Organization: U.S. EPA Commentor:
Pg. # 32 Section # 5.4.1 Paragraph # 1
Original Comment # 83

Sent./Line # 3-9

Comment: It does not appear that a hypothetical receptor would constitute a complete pathway as specified in Section 5.3, (i.e., the four criteria are not all met).

Response: Hypothetical receptors include potential future receptors. (See also Comment No. 182.)

Action: Section 5.3 will be revised to include text which specifically includes future pathways.

191. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 33 Section # 5.4.1 Paragraph #
Original Comment # 84

Sent./Line #

Comment: Table 5-4. It would be more appropriate to identify RME locations for each OU in such a manner as to allow for the development of the MEI when all pathways and all OUs are combined. For OU4, will the resident farmer be upwind or downwind of the silos? From past experiences, the radon risk would be expected to dominate over the shine risk and, therefore, the exposed individual should be downwind unless there are extenuating conditions.

Response: The site-wide risk assessments will include the contributions of all operable units to the risk when all pathways and all operable units are combined. The risk when all pathways and all operable units are combined will not simply be a summation of operable unit pathway risks. Table 5-4 in Section 5.4.1, page 33 is intended to summarize the likely dominant RMEs and corresponding locations for individual operable units based on operable unit risk assessment work performed under the schedules of the 1990 Consent Agreement. Note that the first scheduled deliverable risk assessment is the Site-Wide Baseline Risk Assessment, which will present the RME for the site when all pathways and all operable units are considered collectively.

For OU4, the resident farmer is at the location closest to the silos that the exposure pathway conditions and assumptions reasonably allow. The risk from exposure to radon released from the K-65 silos increases as a function of proximity to the K-65 silos more than as a function of wind direction from the silos. This is confirmed by the trends evident in airborne radon concentration measurement data collected under the WEMCO environmental monitoring program and also the Ohio Department of Health radon study.

Action: Table 5-4 will be revised.

192. Commenting Organization: U.S. EPA Commentor:
Pg. # 35 Section # 5.5 Paragraph #
Original Comment # 85

Sent./Line # 3-20

Comment: There is an alternative to modeling and that is to collect additional data. Actual data may be far superior to any modeled data. Justification should be given as to why further data will or cannot be collected before modeling is initiated.

For all codes used, site specific parameters are highly preferred over reference or generic data. The Ohio Division of Geological Survey and the U.S. Geologic Survey should be relied upon as sources of site parameters.

Response: Collection of site-specific data is preferred over modeling and will be used whenever practicable. There are situations for which modeling of environmental concentrations is the only option. For example, it is not possible to sample every location in a large environmental medium (e.g., regional aquifer) that may be contaminated. Certainly, sampling at the locations most likely to be contaminated in a medium is attempted. The determination of those locations is not without error. Concentrations of contaminants in areas between the sampled locations are estimated by modeling based on the known concentration and properties of the medium. The most obvious example at the FEMP is groundwater modeling of the Great Miami Aquifer. In order to estimate concentrations of contaminants that may occur in the future, modeling is the only method available.

The philosophy that preference will be given to site-specific parameter values has been stated throughout Section 3. The reviewer is referred to lines 13 and 14 on page 3-2 for confirmation of this. The two data sources alluded to by the reviewer have been considered, but it is not the purpose of this work plan to list every potential data source, site-specific or otherwise. Data sources used in the FEMP RI/FS risk assessments will be presented in the Site-Wide Characterization Report, and where appropriate, in each of the OU remedial investigation and feasibility study reports or their companion risk assessment documents. (See also Comment No. 151.)

Action: No action is required.

193. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 36 Section # 5.5 Paragraph # Sent./Line #
Original Comment # 86

Comment: Figure 5-7. This figure should be modified to reflect a decision to or not to collect additional data.

Response: DOE agrees with the comment. (See also Comment No. 194.)

Action: Figure 5-7 will be revised to reflect a decision regarding collection of additional data.

194. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 36 Section # 5.5 Paragraph # Sent./Line #
Original Comment # 87

Comment: Figure 5-7. The accompanying text, page 35, suggests that collection of additional data may be necessary for the quantitative evaluation of a pathway. This option is not reflected in the table and should be included at this stage as an alternative to Modeling Exposure Concentrations.

Response: DOE agrees with the comment. (See also Comment No. 193.)

Action: Figure 5-7 will be revised to reflect a decision regarding collection of additional data.

195. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 1 Section # 6.0 Paragraph # Sent./Line #
Original Comment # 88

Comment: Chapter 6.0. The appropriateness of each model and the accompanying parameter values should be evaluated for each OU unit and approval for each model use given at that time. Models cannot be approved in the absence of conditions and data.

Response: Noted. (See also Comment No. 112.)

Action: Add text to Section 6.0 echoing the commitment, made by DOE in other portions of the Addendum, to follow available EPA guidance during the risk assessments at the FEMP. Also state that DOE understands that final approval of both models and parameters used in a specific risk assessment is dependent on their method of application in that risk assessment.

196. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 2 Section # 6.0 Paragraph # Sent./Line #
Original Comment # 89

Comment: Table 6-1. The following comments are made on the listed codes.

MICROAIRDOS is not one of the AIRDOS-EPA family of codes, but a separate commercial product. Consequently, we are reluctant to see it used but will accept its results so long as all input parameters are supplied to EPA Region V and specific comparisons are made that, with these parameters, establish that results using official AIRDOS-EPA codes are comparable.

Simple Box Model--This model is too primitive for acceptance in this risk assessment. It assumes a uniform concentration in a box of arbitrary dimensions. It is suggested that a model such as the Industrial Source Complex Long Term model be used for near source calculations (< 100 m). Adaptation will have to be made for radionuclides.

PRESTO-EPA-CPG has been modified by many parties. The version used should be the last developed by EPA Office of Radiation Programs. There is also a PC version developed that may be of some use.

RESRAD, in this reviewer's experience, has features that must be recognized before it is used:

The code calculates dose on the basis of large cylindrical sources. Where sources are small in area or snake over the area, the results are obtained by modifications that may or may not be appropriate. Care should be taken when the code is used with these nonstandard source configurations.

The accumulation of dose by radionuclide over long time periods may be confused because decay product dose is listed under the parent dose. For example, if radium-226 and thorium-230 were contaminants of concern, the radium-226 dose would appear to diminish with time even though there is radium-226 ingrowth from thorium-230. This is because the ingrowth dose from radium-226 is registered with the parent, thorium-230, and not registered as total radium-226 dose. The total radium-226 dose could be determined by going into the detailed summary section in the code.

The radon section of the code considers diffusion only, there is no advection section. Advection, from low pressures created within the structure, can dominate diffusion considerably in real situations. Thus, the radon section may underestimate the radon dose. It is recommended that this section not be used.

The default values used in the RESRAD code should be reviewed to ensure that the commitment made in this risk assessment to follow EPA guidelines is adhered to. For example, the default value in RESRAD for drinking water is 410 liters/year while, under EPA's Interim Primary Drinking Water Act, the assumption is 730 liters/year (365 days @ 2 liters/day).

Where RESRAD can be compared to other codes or to EPA guidance, such as slope factors, the comparison should be made to ensure consistency. Please inform EPA Region V about the results of these comparisons.

It may be desirable to add CARBDOSE to the list of potential codes. This code calculates gamma exposure dose from home activated charcoal water treatment units. Where the FEMP site may have increased the groundwater concentration of radon, this will appear as excess gamma exposure from these home units. Where radon levels are high, the exposure rate in some parts of the country has been high enough to require shielding (>5 mR/hr).

For all codes it will be important to use site specific parameters to the extent possible. Where these are not available, Ohio and U.S. geologic surveys should be consulted.

Response: MICROAIRDOS is a version of the AIRDOS-EPA dispersion and dose assessment code specifically developed for microcomputers by R.E. Moore, author of the original AIRDOS code, and John E. Till. Thus it is a member of the AIRDOS family of codes. The model uses the standard Gaussian plume model. DOE proposes to use MICROAIRDOS to model radionuclide concentrations in the air

(X/Q) at potential receptor exposure points (see Section 6.3.1.2, page 28, line 30). DOE foresees little difficulty in establishing that X/Q results from this code will be comparable between MICROAIRDOS and other AIRDOS codes which have been accepted by the EPA.

The box model is robust and lends itself well to situations where resuspension rates, mass loading, and deposition velocities are poorly quantified. Also known as the Near-Field Box Model, the methodology works well in situations where the distance to the receptor (x) is less than the empirical relationship expressed as the width of the source (w) times $\pi/8$ (i.e. when $x < w * \pi / 8$).

The ISC Long Term Model is a Gaussian plume model. It is an area model, and does not lend itself well to analysis of conditions in microclimates, such as ground level receptors which are within 100 meters of the source and/ or in building wakes. (Indeed, in accounting for building wakes, the ISC code uses methodology similar to the simple box model.) The Pasquill-Gifford curves which form the basis of the ISC model begin at a downwind distance of 100 meters. The code will calculate concentrations for distances between 1 and 100 meters, but these are based on extrapolations of equations fit to the Pasquill-Gifford curves above the 100 meter distance. These extrapolations neglect surface turbulence close to ground level area sources. The manual accompanying the code specifically cautions users that the code is not accurate at distances less than 100 meters.

Due to the uncertainties already associated with the near-field air dispersion scenarios, DOE does not deem it appropriate to use a complex, input intensive model when a simple model will suffice. DOE feels that the Near-Field Box Model is appropriate for estimation of ground level concentrations close to the source.

PRESTO-EPA-CPG Yes, with the caveat that the errors in the groundwater, farm, and gamma pathways will be identified, documented, referred to the EPA, and corrected if the code is used.

RESRAD DOE is aware of this.

CARBDOSE DOE will consider this code should the need arise.

Parameter selection. Please see line 16 on page 3-4.

Action: No text change is required.

197. Commenting Organization: U.S. EPA Commentor:
Pg. # 4 Section # 6.1 Paragraph # 1 Sent./Line # 1-10
Original Comment # 90

Comment: The work plan describes pathways for transferring contaminants from the unsaturated zone to the aquifer. The work plan should also describe the potential for migration of volatile organic compounds (VOC) in the gas phase. The impact

on contaminant concentrations in the aquifer from such transfer processes should be discussed.

Response: In general, VOCs are not found in any significant mass at the FEMP. These transfer processes (which would be described at equilibrium by Henry's Law Constant) would affect soil gas, and would not further affect groundwater concentrations, expect to decrease them.

Action: Clarify that this pathway is not of concern at the FEMP.

198. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 9 **Section # 6.1.1.3** **Paragraph # 4** **Sent./Line # 19**
Original Comment # 91

Comment: The reference cited for the "EPA 70-year rule" should be more specifically called out (i.e., Section and Page).

Response: DOE disagrees in principal that reference citations in the text should include Section and page numbers. ~~DOE will be glad to assist EPA reviewers in verifying~~ the existence and applicability of citations on an informal basis, and as time and resources permit. In this particular case, the application of the methodology (named in the work plan addendum as the "70-year rule") is discussed on page 31, Section 2.5.3 of EPA's Superfund Exposure Assessment Manual (1988). This section refers to an earlier section (Section 2.3.3) for details on the methodology itself. (See also Comment No. 117.)

Action: Change reference citation in text.

199. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 9-10 **Section # 6.1.1.4** **Paragraph # 6** **Sent./Line # 29+**
Original Comment # 92

Comment: The procedure for estimating organic contaminant concentrations in leachate is not clear. The text should clarify how Toxicity Characteristic Leaching Procedure (TCLP) test results or the 70-year rule will be used to estimate solubility-based leachate concentrations. Also, the text should explain why contaminant concentrations will decrease logarithmically.

Response: DOE agrees with the comment.

Action: These paragraphs will be revised to clarify the use of Toxicity Characteristic Leaching Procedure (TCLP) test results or the 70-year rule for estimating the solubility-based leachate concentrations.

200. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 18 **Section # 6.1.4.6** **Paragraph # 4** **Sent./Line # 19-20**
Original Comment # 93

Comment: The second sentence should discuss the criteria that will be used to determine similarities in soil types for estimating K_f values.

Response: Typical criteria used to determine similarities in soil types will be discussed in Section 6.1.

Action: Section 6.1.4.6, page 6, paragraph 4 will be revised by inserting the following sentence between the 2nd and 3rd sentences of that paragraph: "Criteria used to determine similarities in soil types include: pH, E_H, mean arithmetic particle diameter, total organic carbon (TOC), cation exchange capacity (CEC), and free ion oxides (FIO)."

201. Commenting Organization: U.S. EPA
Pg. # 18 Section # 6.1.4.6 Paragraph #
Original Comment # 94

Comment: Equation 6-5, A reference should be provided for this equation, and its applicability to estimating K_d values from K_{oc} values should be discussed.

Response: The source of this equation was the Mills et al. 1985 reference in the same paragraph. The use of this equation, and example results are already provided in Section 6.1.

Action: Clarify source of equation.

202. Commenting Organization: U.S. EPA Commentor:
Pg. # 19 Section # 6.1.4.6 Paragraph # 1 Sent./Line # 3-10
Original Comment # 95

Comment: An appropriate reference should be provided for the U.S. EPA Water Engineering Laboratory Treatability Database.

Response: The reference is presented in the text. This is a continuously updated database, under the direction of Kenneth Dosdol of the USEPA. Questions about this electronic database can be addressed to him at USEPA, 26 Martin Luther King Dr., Cincinnati Ohio.

Action: Add "USEPA, Cincinnati, Ohio" to the text.

203. Commenting Organization: U.S. EPA Commentor:
Pg. # 19 Section # 6.1.4.6 Paragraph # Sent./Line # 11
Original Comment # 96

Comment: Equation 6-6, Numerous relationships are available in the literature for estimating K_{oc} from K_{ow} . Equation 6-6 is only one such relationship, and it may not be applicable to all chemicals listed in Table 6-4. K_{oc} values published in recent literature should be used preferentially. If K_{oc} values are not available in the literature, equations for estimating K_{oc} from K_{ow} or water solubility should be used.

The available literature, such as Lyman (1982), should be consulted to determine the criteria for selecting a specific K_{ow} or a solubility-based relationship for establishing K_{oc} .

Response: As stated in lines 12-18 on page 6-19 of the October, 1991 revision of the work plan addendum, DOE is aware of the problems associated with using the K_{ow} value to calculate the K_d value via an intermediate step involving a calculated K_{oc} value. It is DOE's intention to assign K_d values for organic compounds using information from the following hierarchy:

- 1) Site-specific measured K_d values,
- 2) Literature K_d values from soil types similar to those found at FEMP,
- 3) Calculated K_d values from known K_{oc} values, and
- 4) Calculated K_d values from known K_{ow} values

Numerous relationships are available in literature for estimating K_{oc} from K_{ow} based on specific classes of chemicals. Of those relationships presented by Lyman et al. (1982) only $\log K_{oc} = 0.544 \log K_{ow} + 1.377$ based on pesticides, and $\log K_{oc} = 1.00 \log K_{ow} - 0.21$ (which corresponds to $K_{oc} = 0.63 K_{ow}$) based on aromatic or polynuclear-aromatics are applicable to the chemicals listed in Table 6.4. For chlorinated hydrocarbons and alkylbenzenes $\log K_{oc} = 0.72 \log K_{ow} + 0.49$ (Cleary et al. 1991) is one of the better known relationships. Comparisons were made on some of the chlorinated hydrocarbons using the different relationships and the literature values. The results of these comparisons indicated calculated K_{oc} values differed by less than one order of magnitude which is also true for literature K_{oc} values between different sources. Thus K_{oc} values calculated using the frequently used relationship (Equation 6-6) will be within the uncertainty limits of either the literature values or values calculated by different chemical specific relationships available from literature.

Action: Change text to clarify procedure.

204. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 20 Section # 6.1.4.6 Paragraph # Sent./Line #
Original Comment # 97

Comment: Table 6-3, Is this table inclusive for all radionuclides likely to be found at the FEMP?

Response: Actinium and protactinium were inadvertently omitted from Table 6-3.

Action: Actinium and protactinium will be added to Table 6-3.

205. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 20 Section # 6.1.4.6 Paragraph # Sent./Line #
Original Comment # 98

Comment: Table 6-3, References should be provided for the K_d values listed.

Response: DOE agrees with the comment.

Action: References will be provided for the K_d values listed in Table 6-3.

206. Commenting Organization: U.S. EPA Commentor:
Pg. # 21 Section # 6.1.4.6 Paragraph # Sent./Line #
Original Comment # 99

Comment: Table 6-4, References should be provided for the K_{ow} , K_d , X_{oc}^s , f , and X_{oc}^f values listed.

Response: DOE agrees with the comment.

Action: References will be provided for the K_{ow} , K_d , X_{oc}^s , f , and X_{oc}^f values listed in Table 6-4.

207. Commenting Organization: U.S. EPA Commentor:
Pg. # 25 Section # 6.2 Paragraph # Sent./Line # 20
Original Comment # 100

Comment: Parameter values for USLE and MUSLE are not listed in Table 6-5, as stated in the text, or elsewhere. This omission should be corrected.

Response: The text is incorrect. The table of parameter values for the universal soil loss equation was removed from the work plan because O_c is the only default value which will be used. Values for the other parameters are highly site/operable unit dependent and will be presented in the appropriate RI/FS risk assessment.

Action: Remove reference to Table 6-5 from Section 6.2.

208. Commenting Organization: U.S. EPA Commentor:
Pg. # 25 Section # 6.3 Paragraph # Sent./Line # 23+
Original Comment # 101

Comment: The work plan should justify use of specific air dispersion models selected for application at a Superfund site such as FEMP. U.S. EPA (1989c) states that atmospheric dispersion models typically used for air permit applications may not be applicable to a Superfund site. Guidelines on Air Quality Models (U.S. EPA, 1986) and U.S. EPA (1989c) should be consulted for appropriate models.

Response: The AIRDOS family of air dispersion models were selected because site-specific data are available for them, and because past performance of these codes on the site is well documented. In general, models will be evaluated based on their general usefulness, demonstrated accuracy for similar applications, their site-specificity, and the specific use made of the model. The last item, specific use, includes a case by case evaluation by both DOE and the EPA of a model's compatibility with the scenario's conceptual model, and of the representativeness of the parameters used. If compelling reasons are presented demonstrating that the model is not

appropriate, provisions have been made in the addendum to substitute a different model which would be appropriate.

Action: Revise the text to justify selection of the AIRDOS code and site-specific parameters.

209. Commenting Organization: U.S. EPA Commentor:
Pg. # 30 Section # 6.3.1.3 Paragraph # Sent./Line # 18
Original Comment # 102

Comment: Equation 6-21, "LS" should be defined.

Response: DOE agrees with the comment.

Action: The parameter "LS" in Equation 6-21 will be defined.

210. Commenting Organization: U.S. EPA Commentor:
Pg. # 31 Section # 6.3.1.3 Paragraph # 1 Sent./Line # 2
Original Comment # 103

Comment: The first sentence is not complete and should be revised.

Response: DOE agrees with the comment.

Action: The sentence will be revised to read: "Estimations will be made of airborne concentrations of contaminants in the gaseous phase such as volatile organic compounds (VOCs) and radon."

211. Commenting Organization: U.S. EPA Commentor:
Pg. # 31 Section # 6.3.2.1 Paragraph # 2 Sent./Line # 10-15
Original Comment # 104

Comment: The volatilization models do not address VOC emissions from sources other than those related to remedial activities. The work plan should clarify why such sources are not addressed.

Response: A model describing volatilization from home water use will be included. (See also Comment No. 38.)

Action: The Andelman model (from RAGS Part B) will be used to estimate air concentrations of organic chemicals from volatilization from water used in the home.

212. Commenting Organization: U.S. EPA Commentor:
Pg. # 31 Section # 6.3.2.1 Paragraph # Sent./Line # 18
Original Comment # 105

Comment: Equation 6-22, Use of this equation for estimating the emission rate should be justified. U.S. EPA (1989d) specifically discusses air emissions from remedial activities; this source should be consulted for appropriate models.

Response: The models presented in Section 6.0 rely on standard parameters and concepts used in most emissions models.

Action: No text change is required.

213. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 35 **Section # 6.4** **Paragraph # 2** **Sent./Line # 8-25**
Original Comment # 106

Comment: Before modeling dermal uptake of radionuclides the USEPA Region V Radiation Section should be consulted. The reason for this is that EPA issued "Interim Guidance for Dermal Exposure Assessment" (EPA 600/8-91-0011A, March 1991). Using this document might lead to an assumption of high dose attributable to dermal uptake of metals like uranium. Since this diverges from historical assumptions in health physics, EPA wishes to discuss the matter with our Headquarters before modeling is initiated for this pathway.

Response: The methodology presented in the work plan addendum will be used because it is consistent with EPA guidance issued in "Interim Guidance for Dermal Exposure Assessment" (EPA/600/8-91/011A, March 1991) and RAGS. In addition, the letter from John Schaum (Schaum 1991) will be used as it applies. (See also Comment Nos. 69 and 75.)

Action: No text change is required.

214. **Commenting Organization:** U.S. EPA **Commentor::**
Pg. # 39 **Section # 6.6** **Paragraph #** **Sent./Line # 17+**
Original Comment # 107

Comment: When two codes are able to calculate the same quantity they should be intercompared.

Response: See line 20 on page 6-1 of the October, 1991 revision of the work plan addendum.

Action: No text change is required.

215. **Commenting Organization:** U.S. EPA **Commentor::** Van Leeuwen
Pg. # 3 **Section # 7.0** **Paragraph # 1** **Sent./Line # 1-6**
Original Comment # 108

Comment: As noted in the review of the prior draft, it is permissible to subtract the background concentration for radionuclides to calculate the site-influenced risk to these chemicals. However, when a comparison to background radionuclide risks is to to [sic] included in the risk assessment, it is more reasonable to compare the

as the latter represents the total exposure to the identified receptors. This comparison better illustrates the impact of the added risks due to the site.

For non-radioactive organics, the background is assumed to be zero; therefore, comparison with background is unnecessary. A good approach would be to prepare a summary table showing the background risk, risk from chemicals at the site and the total population risk from background-plus-site.

Response: Comparison of the background risk to the risk from background plus site-influenced risk represents the contribution of background risk to the total risk to the receptor. Comparison of the site-influenced risk to the risk from background plus site-influenced risk represents the contribution of the site risk to the total risk to the receptor. The latter comparison is more appropriate because it better illustrates the impact of the added risks due to the site. The suggestion of the summary tabulation of background risk, site risk, and total risk will be incorporated into RI/FS risk assessments. (See also Comment Nos. 65 and 220.)

Action: Section 7.1 will be revised to incorporate the suggestion of comparing background risks, site-related risks, and the total risks (background plus site-related). In addition, Section 7.1 will be revised to indicate that background concentrations of organic chemicals will be assumed to be zero.

216. **Commenting Organization:** U.S. EPA **Commentor::**
Pg. # 1 Section # 7.1 Paragraph # 2 Sent./Line # 7-10
Original Comment # 109

Comment: The two step approach outlined in this section is reasonable, but was not well defined in Section 6 where modeling was given as the only alternative to insufficient data. Section 6 should be modified to reflect the two step approach of this paragraph, namely when data is insufficient in quality or quantity more data will be gathered if possible and, if not possible, then modeling will be used.

Response: DOE agrees with the comment.

Action: The following will be added to the end of the first paragraph of Section 6.0:
"Modeling is performed if the quality or quantity of measurement data is insufficient and if additional measurement data cannot be obtained."

217. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 2 Section # 7.1.2 Paragraph # 3 Sent./Line # 15
Original Comment # 110

Comment: Equation 7-1, According to U.S. EPA (1989a), either the 95-percent upper confidence limit (UCL) or the maximum concentration detected, may be used, but not the mean. The equation should be revised accordingly.

Response: DOE agrees with the comment. (See also Comment Nos. 63 and 219.)

Action: Section 7.1.1 will be revised to be consistent with EPA Region V guidance for determining exposure concentrations from measured data (EPA 1991c).

The list of references will be revised to include:

United States Environmental Protection Agency, 1991c, "Future Residential Land Use Ground Water Exposure Point Concentrations for the Baseline Risk Assessment," Memorandum from John Kelly to Remedial and Enforcement Response Branch RPMs and Supervisors, May 10, 1991, Region 5, Chicago, IL.

218. Commenting Organization: U.S. EPA Commentor:
Pg. # 2 Section # 7.1.2 Paragraph # 3 Sent./Line # 15
Original Comment # 111

Comment: Equation 7-1, The source of the value 1.96 should be provided.

Response: Section 7.1 needs to include a more precise and accurate description of the methodology for calculating constituent concentration values for measured data.

Action: Section 7.1 will be revised to present the methodology for calculating the contaminant concentration values for measured data.

219. Commenting Organization: U.S. EPA Commentor:
Pg. # 2 Section # 7.1.2 Paragraph # 3&4 Sent./Line # 11-26
Original Comment # 112

Comment: Deviation from the 95th percentile protocol should not result in an arbitrary substitution as proposed here. It is entirely possible that unmeasured concentrations on a site may be higher than any measured to date. This is an assumption of the 95th percentile protocol. The 95th percentile approach should be maintained.

Response: As noted in EPA Region V guidance for selecting exposure point concentrations from measured data for the "baseline risk assessment future residential land use ground water scenario," the maximum contaminant concentration should be used if it is lower than the upper 95% confidence limit (EPA 1991c). (See also Comment Nos. 63 and 217.)

Action: Section 7.1 will be revised to be consistent with EPA Region V guidance for selecting exposure concentrations from measured data.

The list of references will be revised to include:

United States Environmental Protection Agency, 1991c, "Future Residential Land Use Ground Water Exposure Point Concentrations for the Baseline Risk Assessment," Memorandum from John Kelly to Remedial and Enforcement Response Branch RPMs and Supervisors, May 10, 1991, Region V, Chicago, IL.

220. Commenting Organization: U.S. EPA Commentor:

Pg. # 3 Section # 7.1.2 Paragraph # 1 Sent./Line # 1-6
Original Comment # 113

Comment: It is reasonable to subtract background concentrations of naturally occurring radionuclides from on-site concentrations, but this should not be done for manmade radionuclides. There should be no natural background levels for manmade radionuclides. Also, the text should clarify whether subtraction of background concentrations for naturally occurring radionuclides will be done for each sample before calculating on-site means, or after the means are calculated. Also, natural background concentrations to be subtracted should be obtained from samples from similar geologic formations well outside the influence of the site.

Response: For the Site-Wide Characterization Report background concentrations will be subtracted for naturally-occurring radionuclides. A background concentration of zero will be assumed for other radionuclides. While man-made radionuclides are not "naturally" occurring, concentrations of man-made radionuclides attributable to sources other than the FEMP site potentially do exist in the environment (fallout from atom bomb tests, releases from other sites). DOE is preparing a sampling and analysis plan to obtain sufficient site-specific data to characterize background concentrations in soil (levels not attributed to the FEMP site). (See also Comment Nos. 65 and 215.)

Action: Section 7.1 will be revised to include the following: "The 95% confidence limit on the arithmetic mean for the background concentration for each carcinogen (including radionuclides) will be subtracted from the site-related UCL for the carcinogen to determine exposure concentrations of carcinogens at exposure points. In this way the quantified exposure and risks that represent the excess attributable to contamination from the site can be presented. In addition, exposures to background concentrations of carcinogens (including radionuclides) will be assessed to provide the risks associated with exposures that are not attributed to the site. This information facilitates the important comparison of the background risks, the added risks due to the site, and the total risk (background risk plus risk from the site).

Background concentrations of chemical toxicants will not be subtracted from UCL values when determining exposure point concentrations. Thus, the quantified exposure and risk represent that which is attributable to contamination from the site plus background."

221. Commenting Organization: U.S. EPA Commentor:
Pg. # 3 Section # 7.1.2 Paragraph # 1 Sent./Line # 1-6
Original Comment # 114

Comment: There is no reason to spend time and money quantifying exposures and risks from background when these are unavoidable. Risks will be specified as excess risk in any case. Delete the two sentences beginning "In addition, exposures.... to the site."

Response: This comment is inconsistent with Comment Nos. 215 and 220. This inconsistency was resolved at the January 16, 1992 meeting between DOE and EPA. Action will be taken consistent with Comment Nos. 215 and 220.

Action: No text change is required.

222. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 3 **Section # 7.1.3** **Paragraph #** **Sent./Line # 12-18**
Original Comment # 115

Comment: Direct sampling is superior to modeling. Modeling should be viewed as a last resort when direct sampling is not possible.

Response: DOE agrees with the comment. Section 7.1.3 presents the most common (and obvious) condition under which modeled concentrations must be used, namely, for assessment of future potential exposures. Modeling exposure concentrations at potential receptor locations for current exposure pathways is also necessary for large groundwater systems (such as at the FEMP) which cannot be sufficiently characterized by sampling to quantify the RME.

Action: No action is required.

223. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 6 **Section # 7.2.1.2** **Paragraph #** **Sent./Line # 20+**
Original Comment # 116

Comment: This section does not include the methodology used for radon decay product intakes. The units would be working levels (WL), not picocuries (pCi), and might also have to involve an equilibrium factor.

Response: The methodology presented in Section 7.2.1.2, page 6 is consistent with RAGS and the use of the EPA Health Effects Assessment Summary Tables (HEAST). The HEAST provides an EPA slope factor expressed as cancer risk per unit radioactivity intake (cancer risk per pCi) for quantifying the risk for radon and radon decay product intakes. Therefore, the calculation of pCi intake is appropriate for risk assessments under CERCLA. (See also Comment No. 246 and 248.)

Action: No text change is required.

224. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 7 **Section # 7.2.1.3** **Paragraph #** **Sent./Line # 4-23**
Original Comment # 117

Comment: The soil/sediment ingestion pathway is not limited to children. Incidental ingestion of soil by farmers, gardeners, workers and other adult populations can be sizeable. An ingestion rate of 100 mg/day can be used for these population groups as shown on page 16 of this section. The text should be corrected here to show that all populations will be considered for this pathway.

Response: The text does not state that children are the only receptors. The reviewer is referred to lines 8-20 on page 7-16 of the work plan addendum, where it can be demonstrated that the intent of the work plan addendum is to consider all age groups in this pathway. To further clarify this, the presentation of intake rates will resemble the format used in RAGS PART B.

Action: Explicitly state this philosophy in Section 7.2.1.3.

225. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 8-11 Section # 7.0 Paragraph # Sent./Line #
Original Comment # 118

Comment: The calculations for the ingestion of vegetables, fruit, dairy products and fish given on these pages should follow OSWER Directive 9285.6-03, Human Health Evaluation Manual Supplemental Guidance: "Standard Default Exposure Factors" or justifications presented for not following this guidance. Site-specific data should be used whenever possible. The fraction of home-produced fruits and vegetables may not be appropriate for the area surrounding the site, due to the high consumption of home-grown and locally-grown products (some on FEMP and adjacent land). Parameter values given on page 15 should also be consistent with the OSWER Directive.

Response: Other than by reference to the standard intake calculation equation from RAGS, OSWER Directive 9285.6-03 does not contain calculational methodologies for assessing the intake from the ingestion of vegetables, fruit, dairy products and fish. The purpose of the OSWER Directive is to "...address concerns regarding inconsistencies among the exposure assumptions used in Superfund risk assessments." The parameter values used in the addendum are consistent with the OSWER directive. It should be noted that no fruits or vegetables are grown on-property; however, dairy cows do graze on-property. The potential contribution to uncertainty in risk assessment results from the use of default parameter values presented in OSWER Directive 9285.6-03 when site-specific data are not available will be discussed in RI/FS risk assessments.

Action: No text change is required.

226. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 8 Section # 7.2.1.4 Paragraph # Sent./Line #
Original Comment # 119

Comment: Equations 7-8 and 7-9, If RESRAD will be used for these calculations, are these the same equations used in the RESRAD code?

Response: RESRAD uses the conceptual models presented in U.S. NRC Regulatory Guide 1.109, which are the bases for equations 7-8 and 7-9. In RESRAD, the algorithms are broken down into smaller components and solved. The solutions are then stored in data files for later recombination and use. The equations in RESRAD differ slightly from those presented in the addendum. The algorithm presented in

the RESRAD code for the air to plant portion of these transport pathway calculations, includes a factor to convert surface deposition on plants to metabolic uptake by the plants. Exposures are then calculated based only on the amount of a contaminant incorporated in the plant's tissues. The calculations presented in the work plan addendum will allow calculation of exposures from the total concentration deposited and retained on the plant, not just the portion incorporated into the plant. To make these pathways equivalent, the value for T_{ivk} in RESRAD can be set to unity (i.e., the most conservative value). Other differences can be resolved in a similar fashion if the code is utilized for dose assessment purposes. DOE will also attempt to insure that other codes, such as PRESTO, PATHRAE, and/or GENII, are compatible if they are used.

Action: Modify section on multiple pathway codes to reflect the response.

227. Commenting Organization: U.S. EPA Commentor:
Pg. # 10 Section # 7.2.1.5 Paragraph # 2 Sent./Line # 20-23
Original Comment # 120

Comment: The text should explain how the two animal product concentrations (C_{IA}) will be combined when significant soil ingestion is a source of contamination.

Response: The two animal product concentrations will not be combined, instead the two concentrations will be used separately to calculate two separate intakes. Then the two separate receptor intakes are combined by adding them together.

Action: No text change is required.

228. Commenting Organization: U.S. EPA Commentor:
Pg. # 12 Section # 7.2.1.7 Paragraph # 2 Sent./Line # 23
Original Comment # 121

Comment: Equation 7-22, Proposed values for the parameter listed should be indicated. The source of the values and the data used to support their selection should also be specified.

Response: DOE agrees with the comment.

Action: Proposed values for the parameter(s) listed in equation 7-22 will be listed in Section 7.2.2.3, along with the sources of parameter values.

229. Commenting Organization: U.S. EPA Commentor:
Pg. # 13 Section # 7.2.2 Paragraph # 2 Sent./Line # 23-24
Original Comment # 122

Comment: 3rd Bullet, The following U.S. EPA documents should be listed:

- Superfund Exposure Assessment Manual, OSWER 9285.5-1, April 1988 (U.S. EPA, 1988).

- Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," Interim Final, OSWER 9285.6-03, March 25, 1991 (U.S. EPA, 1991).
- Air/Superfund National Technical Guidance Study Series, Volumes I (EPA-450/1-89-001, July 1989), II (EPA-450/1-89-002a, August 1990), III (EPA-450/1-89-003, January 1989), and IV (EPA-450/1-89-004, July 1989) (U.S. EPA, 1989c, 1989d).

Response: The phrase "USEPA reports and other guidance documents" presented in the third bullet was intended to include the cited references. Two documents are already listed as examples under this bullet. This listing of examples in this bullet is not intended to be all inclusive, but rather to serve as an example (hence the parenthetical "e.g.").

Action: A reference to supplemental guidance documents will be included in bullet 2, and the Superfund Assessment and Evaluation Manual will be added to the list of examples in the third bullet.

230. Commenting Organization: U.S. EPA Commentor: Van Leeuwen

Pg. # 13 Section # 7.2.2 Paragraph # Sent./Line # 19-30+

Original Comment # 123

Comment: The reference list should include the OSWER Directive given above as part of the RAGS reference, as this Directive supercedes RAGS guidance in some cases. The Interim Guidance for Dermal Exposure Assessment, OHEA-E-367, March 1991, Exposure Assessment Group, OHEA, Washington, DC, and the recent update letter from John Schaum represent best available guidance regarding dermal absorption pathways and should be used and referenced here.

Response: The phrase "USEPA reports and other guidance documents" presented in the third bullet was intended to include guidance and references like the ones cited by the comment. This listing of examples in this bullet is not intended to be all inclusive, but rather to serve as an example (hence the parenthetical "e.g."). Two documents are already listed as examples under the third bullet, and a third is being added in response to Comment No. 229.

The "Interim Guidance for Dermal Exposure Assessment" (EPA/600/8-91/011A, March 1991) and the recent update letter from John Schaum follow the same methodology as RAGS and the Superfund Exposure Assessment Manual, which is also presented in Section 7.2.1.7 of the addendum. These references will be included in the hierarchy of parameter value sources in Section 7.2.2, page 13.

Action: Include the "Interim Guidance for Dermal Exposure Assessment" (EPA 1991__) and the letter from John Schaum (Schaum 1991) in Section 7.2.2, page 13 in the bullet on lines 20 to 22. Only the parenthetical reference is needed. The full references for these two citations will be added to the work plan addendum Reference List in response to Comment No. 75.

231. Commenting Organization: U.S. EPA Commentor:
Pg. # 14 Section # 7.2.2.1 Paragraph # 3 Sent./Line # 18-26
Original Comment # 124
- Comment: The text should specify which body parts were considered in estimating the skin surface area available for contact with soil or groundwater. The rationale for their selection should also be provided.
- Response: Body parts considered in estimating the skin surface area available for contact with soil or groundwater are not specifically mentioned in the literature. Several formulas are given for estimating surface area in the Exposure Factors Handbook (e.g., model by Gehan and George [1970]).
- Action: No action is required.
232. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 14 Section # 7.2.2 Paragraph # Sent./Line # 23
Original Comment # 125
- Comment: The adult 70 year exposure should include 6 years as a child for all ingestion pathways; the 200 mg/day ingestion rate is appropriate for this age group.
- Response: DOE does not understand the comment. Assuming that the reviewer is discussing material in Section 7.2.2.1, not Section 7.2.2 as stated, a 0.2 g/day intake over the first 6 years of life is clearly presented in lines 8 through 20 on page 7-16 as part of the total lifetime intake.
- Action: Line 4 on page 7-15 will be changed to remove any reference to children which might confuse a reviewer. Request clarification of the comment.
233. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 14 Section # 7.2.2.1 Paragraph # Sent./Line # 18-26
Original Comment # 126
- Comment: Human Physiological Parameters, The body weight usually used for the young child is 15 kg. The body surface area for this and other age groups may vary with the exposure scenario. Refer to the OHEA document (OHEA-E-367), section 2.4, for default values. This guidance supercedes the reference used here.
- Response: A value of 15 kg will be used per the January 16, 1992 discussion with EPA.
- Action: In Section 7.2.2.1, page 7-14, lines 18-26 change the body weight for children aged 1-6 to 15 kg.
234. Commenting Organization: U.S. EPA Commentor:
Pg. # 15 Section # 7.2.2.1 Paragraph # 1 Sent./Line # 1-9
Original Comment # 127

Comment: The text should clarify whether an 18-year-old person is considered a child/teen or an adult. If such a person is considered a child/teen, then the exposure duration for that age group should be 13 years and not 12 years as shown. If an 18-year-old person is considered an adult, then the child/teen age group should be defined as ages 6 to 17 years.

Response: 12 years is correct.

Action: Ages will be further clarified in the text.

35. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 15 **Section # 7.2.2.1** **Paragraph #** **Sent./Line # 1-9**
Original Comment # 128

Comment: Exposure Duration, See comments 224 and 232 above, regarding inclusion of populations for soil ingestion pathways.

Response: See response to Comment Nos. 224 and 232.

Action: The parenthetical "(child only, ages <6:)" on line 4, page 7-15 will be deleted to remove any reference to children.

36. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 15 **Section # 7.2.2.1** **Paragraph #** **Sent./Line # 10-15**
Original Comment # 129

Comment: Time Use Patterns - Although EPA office of Radiation Programs assumes citizens are exposed indoor to radon for 75% of the year, Superfund guidance of 50% can be used here. This chart does not account for time spent below grade (radon decay product levels are greater in a basement) nor for time offsite.

Response: Time spent away from the site is not accounted for to accommodate a resident farmer scenario, which is expected to be the typical RME for most exposure pathways. A reference could not be found for time fraction spent in a basement; therefore, a value is not included in the addendum. It will be assumed that the receptor is exposed to either the maximum constituent air concentration indoors or the upper 95 percent confidence limit on the arithmetic mean air concentration during the entire fraction of time spent indoors to obtain an upper bound estimate of exposure for the indoor pathway.

Action: No text change is required.

237. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 15 **Section # 7.2.2.1** **Paragraph #** **Sent./Line # 25-32**
Original Comment # 130

Comment: Pathway - Values in this table do not agree with the default values in RESRAD. Assurance must be made that, consistently, across all codes used, there is agreement on specific and default parameters.

Response: Section 6.0, page 1, lines 18-21, states: "One goal of the modeling effort is to use input parameters and default values that are consistent with the EPA recommendations. It is intended that input parameters and default values be used consistently for all models. Cross-checking of the results of the different models will be performed where possible."

Action: No text change is required.

238. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 16 **Section # 7.2.2.1** **Paragraph # 1** **Sent./Line # 8-20**
Original Comment # 131

Comment: The soil ingestion rates presented are already averaged over a full 1-year period. The exposure frequency to be used with these rates should be 365 days per year.

Response: The 350 days per year exposure frequency is used to comply with the supplemental guidance to RAGS (OSWER Directive 9285.6-03) (See also Comment No. 225.)

Action: No text change is required.

239. **Commenting Organization:** U.S. EPA **Commentor:** Van Leeuwen
Pg. # 17 **Section # 7.2.2.1** **Paragraph #** **Sent./Line # 1-15**
Original Comment # 132

Comment: FI - The reference given here (1989a) has been superceded by more current guidance (1991c). This is the better reference for default values for vegetables, fruit, DW, and soil.

Response: The reference citation will be changed to reflect the comment.

Action: In section 7.2.2.1, page 17, lines 13 and 14, change the reference citations from "(EPA 1989a)" to "(EPA 1991c)".

240. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 17 **Section # 7.2.2.1** **Paragraph #** **Sent./Line # 5-12**
Original Comment # 133

Comment: Item Ingested - Are these assumptions the same as those in RESRAD? These values are not expressly stated in the code.

Response: These values are expressed in the RESRAD code or its accompanying input data files in some form. Some are incorporated as part of the pathway conversion factors in the code. However, it must be restated here again that RESRAD does not currently incorporate EPA/HEAST methodology, as stated in lines 27-29 of the

October, 1991 revision of the work plan addendum. DOE does not plan to use this code to evaluate risks at the site.

Action: No text change is required.

41. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 20 Section # 7.2.2.2 Paragraph # Sent./Line # 30-34
Original Comment # 134

Comment: PCs - As noted in the prior review of this section, the permeability constants listed in the 1988 EPA document referenced here are not correct. Chemical-specific permeability constants should be obtained from the OHEA document referenced earlier or from ECAO. The PC of water is only appropriate as a default for inorganics; it may not be used for organic chemicals. See the Schaum letter included as an attachment.

Response: The John Schaum letter directs the risk assessor to the dermal exposure assessment guidance (March 1991) for permeability constant (PC) values for volatiles and semivolatiles, with specific exceptions. The letter presents a correlation with K_{OW} and molecular weight to be used for organics not covered in the March 1991 draft dermal exposure assessment guidance. He presents all PC values in units of cm/hr. The letter also provides PC values (in cm/hr) for cobalt, lead, silver, zinc, cyanide, and specifies the use of 1×10^{-3} cm/hr for other metals. The Addendum will adopt the use of the dermal exposure assessment guidance (EPA/600/8-91/011A, March 1991) and the John Schaum letter (for his exceptions to the guidance document). The ECAO will be consulted regarding constituents not addressed in EPA guidance.

Action: The text pertaining to skin permeability constants presented in Section 7.2.2.3 will be revised to state that the EPA guidance for dermal exposure assessment from John Schaum will be followed. This guidance will be summarized and presented in the text.

242. Commenting Organization: U.S. EPA Commentor:
Pg. # 20 Section # 7.2.2.1 Paragraph # Sent./Line # 6-19
Original Comment # 135

Comment: Concentration Ratio - These biouptake factors are not the same as those used in RESRAD. Assurance must be made that, consistently, across all codes used, there is agreement on specific and default parameters.

Response: Section 6.0, page 1, lines 18-21, states: "One goal of the modeling effort is to use input parameters and default values that are consistent with the EPA recommendations. It is intended that input parameters and default values be used consistently for all models. Cross-checking of the results of the different models will be performed where possible."

Action: No text change is required.

243. Commenting Organization: U.S. EPA Commentor:
Pg. # 21 Section # 7.2.2.1 Paragraph # Sent./Line # 27-25
Original Comment # 136

Comment: Conversions for uranium - The assumption that there is undisturbed uranium on site is extremely questionable. Why are these conversion values introduced?

Response: Because the FEMP has a history of having processed uranium ore it is reasonable to expect that U-234, U-235, and U-238 in their natural percent abundances exist at the site. For example, the uranium extracted from ore at the site and processed into product or lost in process waste streams would be expected to contain natural percent abundances of uranium. Thus, the waste pits, waste silos, and other stored wastes would be expected to contain natural percent abundances of uranium. Therefore, the conversion factor presented can be useful. However, it is not assumed that all of the uranium at the site is present in natural percent abundances.

Action: No text change is required.

244. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 21 Section # 7.2.2.2 Paragraph # Sent./Line # 1-3
Original Comment # 137

Comment: ABS - Dermal absorption values should be taken from the OHEA document, Schaum letter updating this guidance and data provided by literature review from ECAO. The contractor should not use values from the open literature which have not been approved by ECAO.

Response: DOE agrees with the comment.

Action: The text pertaining to dermal absorption values presented in Section 7.2.2.3 will be revised to state that the EPA guidance for dermal exposure assessment from John Schaum will be followed. This guidance will be summarized and presented in the text.

245. Commenting Organization: U.S. EPA Commentor:
Pg. # 22 Section # 7.2.2.1 Paragraph # Sent./Line # 1-2
Original Comment # 138

Comment: Radiation Shielding Factor - RESRAD assumes a factor of 0.7 in its occupancy calculations and a factor of 0.4 for indoor air concentrations compared to outdoor concentrations. Which will be used in these calculations?

Response: The value of 0.5 for radiation shielding factor presented in Section 7.2.2.3, page 22, lines 1 and 2 will be used. Section 6.6, page 39, paragraph 2 states that codes such as RESRAD will not be used to assess risks because it does not use the EPA risk calculation methodology (RAGS and HEAST).

Action: No text change is required.

46. Commenting Organization: U.S. EPA Commentor:
Pg. # 14 Section # 7.2.2.1 Paragraph # Sent./Line #
Original Comment # 139

Comment: General Statement - This section lacks many of the parameters and equations associated with radon. What concentration to working level values will be used for radon-222, for radon-220? What equilibrium factors for the various isotopes of radon will be used, both indoors and outdoors.?

What equations will be used to convert concentrations to working levels to working level months?

Response: The methodology presented in Section 7.2 is consistent with RAGS and the use of the EPA Health Effects Assessment Summary Tables (HEAST). The HEAST provides an EPA slope factor expressed as cancer risk per unit radioactivity intake (cancer risk per pCi) for quantifying the risk for radon and radon decay product intakes. Therefore, the calculation of pCi intake is appropriate for risk assessments under CERCLA. Equations and parameter values otherwise associated with quantification of exposure to radon and radon progeny are not required when the methodology presented in RAGS and HEAST is used. (See also Comment No. 223 and 248.)

Action: No text change is required.

247. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 10 Section # 7.2.3.5 Paragraph # Sent./Line #
Original Comment # 140

Comment: As suggested in the past review of this section, it would seem more reasonable to use actual data for the radionuclide concentrations in meat and milk, rather than to model it. Some earlier data is available on the incorporation of radionuclides in these products and sampling could be included at the site to give more site-specific values. At the minimum, comparison with values obtained by actual measurements in other studies should be included in the risk assessment to support the values obtained by modeling.

Response: Reliable site-specific data on radionuclide concentrations in meat are not available. The limited data available do not indicate detectable incorporation of uranium into muscle tissue of cows grazing on FEMP property. Site-specific data on radionuclides in milk are available in Environmental Monitoring Reports and can be used to supplement model predictions for current exposure scenarios. Analytical results are consistently below or slightly above detection limits and do not show evidence of being significantly different from analytical results from control samples. Modeling will be performed for constituents in addition to radionuclides. Comparison of modeled results to analytical results should be performed in the risk assessments, not in the work plan addendum.

Action: Following Line 19, Page 10, Section 7, add: "Site-specific data on radionuclides in milk, available in Environmental Monitoring Reports, will be used to supplement model predictions for current exposure scenarios."

248. Commenting Organization: U.S. EPA Commentor:
Pg. # 22 Section # 7.2.3 Paragraph # Sent./Line # 3-10
Original Comment # 141

Comment: Radon decay product intake can be expressed as working levels (WL). Most radon dose conversion factors are expressed in working level months (WLM).

Response: The methodology presented in Section 7.2 is consistent with RAGS and the use of the EPA Health Effects Assessment Summary Tables (HEAST). The HEAST provides an EPA slope factor expressed as cancer risk per unit radioactivity intake (cancer risk per pCi) for quantifying the risk for radon and radon decay product intakes. Therefore, the calculation of pCi intake is appropriate for risk assessments under CERCLA. Equations and parameter values otherwise associated with quantification of exposure to radon and radon progeny are not required when the methodology presented in RAGS and HEAST is used. (See also Comment Nos. 223 and 246.)

Action: No text change is required.

249. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 22 Section # 7.3 Paragraph # Sent./Line # 14+
Original Comment # 142

Comment: As noted in the prior review, the method suggested for the calculation of the external radiation exposure requires some discussion. RAGS, pages 10-24, suggests [sic] that the pathways to be considered include immersion in contaminated air, immersion in contaminated water and radiation exposure from ground surfaces that are contaminated. Page 10-25 of RAGS recommends using methods identical to the calculation of internal exposures, so that contributions from all pathways can be summed. Please address these points in this discussion.

Response: The comment notes three external radiation exposure pathways from RAGS page 10-24:

- External radiation exposure from immersion in contaminated water
- External radiation exposure from contaminated ground surfaces
- External radiation exposure from immersion in contaminated air

Immersion in contaminated water is already included in Section 5.3, page 31, line 4, pathway number 31. Radiation exposure from contaminated ground surfaces is already included in Section 5.3, page 28, line 16, pathway number 14. Please see Table 5-3 for a summary of exposure pathways selected for quantitative evaluation in the risk assessment. Radiation exposure from immersion in contaminated air will be included in Section 5.3.

The comment suggests calculating external radiation exposures using methods identical to those for calculating internal exposures to radionuclides. The methodology for calculating internal exposures to radionuclides result in a radioactivity intake (pCi) so that corresponding risks can be calculated using radionuclide-specific HEAST cancer slope factors expressed per unit intake (pCi⁻¹). Calculated external radiation exposures result in a dose equivalent (mrem) rather than a radioactivity intake. Risks corresponding to the external radiation exposure dose equivalents are calculated using the EPA external radiation exposure risk coefficient of 6.2×10^{-7} mrem⁻¹ (the use of this EPA risk coefficient is addressed in Section 9.2.2.2, page 5). Intakes in pCi can also be expressed as mrem using EPA radionuclide-specific dose conversion factors so that the internal radiation exposures and external radiation exposures can be combined (where coincident) or compared.

Action: Section 5.3 will be revised to include the pathway involving external exposure from immersion in contaminated air.

250. Commenting Organization: U.S. EPA Commentor:
Pg. # 23 Section # 7.3 Paragraph # 0 Sent./Line # 1-3
Original Comment # 143

Comment: A reference should be cited for the geometric values presented.

Response: DOE agrees with the comment.

Action: EPA's HEAST Appendix C will be cited.

251. Commenting Organization: U.S. EPA Commentor:
Pg. # 28 Section # 7.4.2.1 Paragraph # 2 Sent./Line #
Original Comment # 144

Comment: The criteria used in selection of the indicator species should be discussed.

Response: The selection of terrestrial indicator species was based on species abundance on the FEMP, trophic level position, and habitat requirements.

Action: At Section 7.4.2.1, Page 28, Line 16, insert: "The selection of terrestrial indicator species was based on species abundance on the FEMP, trophic level position, and habitat requirements."

252. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 2 Section # 8.0 Paragraph # Sent./Line # 16-17
Original Comment # 145

Comment: Toxicity values should be derived by ECAO using a full literature search. Where no guidance can be provided, it may be more desirable to do a qualitative risk assessment rather use inappropriate toxicity values. Guidance from USEPA should be sought in such cases.

Response: The data from the literature is not "DOE-response data," but "dose-response data" from the scientific community. The reference to "DOE-response" in the work plan is a typographical error. We expect that RfDs or CSFs generated for the risk assessments will be sent to ECAO once EPA receives the reports. (Schedules will not allow for pre-submittal review). (See also Comment No. 131 and 133.)

Action: The typographical error will be corrected. In Section 3.4, page 5, revise line 31 to read: "Dose-response data from the open literature".

253. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 3 **Section # 8.2** **Paragraph # 4** **Sent./Line # 18-26**
Original Comment # 146

Comment: Age specific and gender specific risk factors found in EPA 1989b, both Table 6-6 and 6-7, can be used in risk assessments. Risk factors for radon should also be defined in this document, both for radon-222 and radon-220.

Response: Table 6-6 of NESHAPS (EPA 1989b) presents cancer mortality risks while Table 6-7 presents cancer incidence risks. The nominal risk factors presented in Table 6-27 of NESHAPS "...reflect EPA's best judgement as to the relationship between dose and risk based on review of all relevant information available to the Agency." Therefore, the EPA nominal risk factors presented in Table 6-27 of NESHAPS will be used, not age or gender specific values. The risk coefficient of 6.2×10^{-7} mrem⁻¹ is based on Table 6-27. In addition, EPA's cancer slope factors for radionuclides (from HEAST) are age-averaged values of lifetime total excess cancer risk, not age and gender specific values. Age-specific risk factors are not available for chemicals.

Risks for radon exposures are quantified using the intake estimation approach from RAGS followed by application of the HEAST slope factor for radon. (See also response to Comment No. 223.)

Action: No text change is required.

254. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 7 **Section # 8.5** **Paragraph #** **Sent./Line # 1-24**
Original Comment # 147

Comment: The uncertainty discussion should be an honest appraisal of the limitations of the results developed but should avoid language that may discredit work that would have widespread acceptance in the scientific and regulatory communities.

Response: The uncertainty discussion will not discredit work widely accepted in the scientific and regulatory communities. The kinds of uncertainties described in the work plan addendum are well recognized in the scientific community as concerns for risk assessment. These are important to note, particularly in the ecological assessment, where regulatory guidance is both more recent and more limited than for human health risk assessment.

2879

Action: No text change is required.

5. Commenting Organization: U.S. EPA Commentor:
Pg. # 2 Section # 9.2.1.1 Paragraph # 3 Sent./Line # 13-21
Original Comment # 148

Comment: Risk factors are available for exposure via inhalation and ingestion but not dermal contact. This paragraph should include a discussion of the method to be used to derive slope factors for estimating risks resulting from exposure via dermal contact.

Response: The methodology presented in the work plan addendum will be used because it is consistent with EPA guidance issued in "Interim Guidance for Dermal Exposure Assessment" (EPA/600/8-91/011A, March 1991) and RAGS. In addition, the letter from John Schaum (Schaum 1991) will be used as it applies. (See also Comment Nos. 69 and 75.)

Action: No text change is required.

56. Commenting Organization: U.S. EPA Commentor:
Pg. # 3 Section # 9.2.1.2 Paragraph # 1 Sent./Line # 1-9
Original Comment # 149

Comment: The text should indicate how short-term (acute) risks will be quantified, and the source of acute toxicity values should be identified. Also, this paragraph should include discussion of the method to be used to derive reference doses for estimating risks resulting from exposure via dermal contact.

Response: Acute risks are quantified the same way chronic risks are, with the exception of using sub-chronic RfDs. Sub-chronic RfDs are obtained from the sources mentioned in Section 8.0 (e.g., HEAST and IRIS).

Action: No text change is required.

57. Commenting Organization: U.S. EPA Commentor:
Pg. # 3 Section # 9.2.1.2 Paragraph # 5 Sent./Line # 18-25
Original Comment # 150

Comment: The text should note that although U.S. EPA (1989a) approves summation of noncarcinogenic risk by target organ, approval is required from the Environmental Criteria and Assessment Office (ECAO) for segregation of risks below the target organ level.

Response: DOE does not plan to group noncarcinogenic chemicals by biochemical mechanisms or metabolic processes.

Action: Change sentence to read: "Hazard Indices will be determined by assuming dose additivity for those chemicals that effect the same target organ."

2811

2799

258. Commenting Organization: U.S. EPA Commentor:
Pg. # 4 Section # 9.2.2.2 Paragraph # last Sent./Line # 29-31
Original Comment # 151

Comment: 10 cm is inappropriate for the radionuclides of concern at this site. Gamma emissions from radium-226, radium-228 and thorium-228, especially, may penetrate several ten's of centimeters of soil. For example, the dose from a 10 cm layer of thorium-228 under 50 cm of cover is still about 2-3% of the dose without cover.

Response: DOE is following EPA methodology for the evaluation of risks from radiologically contaminated surface soils. EPA used a 10-cm soil depth in its example calculation involving Cs-137 and Ba-137m in Appendix C of the 1991 HEAST. The principal gamma radiation from this series is the 662 keV gamma emission (85% yield). The Th-228 cited by the reviewer has a maximum gamma emission of 216 keV. If this example is representative, then the selection of a 10 cm depth for Th-228 is appropriately conservative using EPA methodology, since the Th-228 gamma spectrum has a lower yield and energy than that of Ba-137m. DOE has proposed using conventional dose/risk assessment methodology to assess risks from direct radiation emitted by any source other than surface soil. See lines 2 through 8 on page 7-23 for DOE's intent in this matter.

Action: No text change is required.

259. Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Pg. # 2 Section # 9.2.1.1 Paragraph # Sent./Line # 24
Original Comment # 152

Comment: Equation 9.2 - Risk(T) is a mislabel. The cumulative risk shown in the equation should be properly labeled Risk (P) for pathway risk. The total risk is the risk from all chemicals in all pathways.

$$\begin{aligned}\text{Risk (P)} &= \text{Risk (chem1)} + \text{Risk (chem2)} + \dots \text{Risk (chemi)} \\ \text{Risk (T)} &= \text{Risk (P1)} + \text{Risk (P2)} + \dots \text{Risk (Pi)}\end{aligned}$$

Response: Equation 9-2 will be revised to reflect the comment.

Action: In Section 9.2.1.1, page 2, lines 24 and 26 change "Risk_T" to "Risk_P".

260. Commenting Organization: U.S. EPA Commentor:
Pg. # 9 Section # 9.5 Paragraph # 1 Sent./Line # 2
Original Comment # 153

Comment: The pledge should be to discuss estimations objectively, not to presume the entire estimate is overstated.

Response: DOE agrees that the discussion of uncertainties in the Risk Assessment Work Plan Addendum, as well as the discussions in subsequent risk assessments, should describe the realistic limits of estimated risks in an unbiased manner. DOE recognizes that

at each step of the risk assessment process, source term estimates, transport parameters, and exposure parameters are taken from their respective distributions of possible values so as to overestimate the source, transport, and exposure. The combination of estimated values (e.g., parameters) exceeding the mean or median value for each step of the risk assessment will cause the final risk estimate to exceed the mean or median of the estimated risk. In many cases this estimation will greatly exceed the "95 percent confidence level" for the calculated risk. Therefore, the overall uncertainty of the risk is such that risks exceeding the estimated (reported) risk are much less likely than risks lower than the reported value. (See also Comment Nos. 108, 119, and 263.)

Action: Sections 9.5 and 10.1.2 will be revised to improve the explanation of sources and magnitudes of uncertainties that can lead to overestimation and underestimation of risks.

51. Commenting Organization: U.S. EPA Commentor:
Pg. # 3 Section # 10.1.1 Paragraph # Sent./Line #
Comment # 154

Comment: ~~The issue of ARAR-based cleanup goals versus risk-based cleanup goals is laid out here. The document clearly takes the position of the former over the latter. This is an issue that needs resolution.~~

Response: This is an issue we feel can not be resolved in this work plan. We will alter the section so that the DOE position appears neutral on the issue.

Action: Section 10.0 will be revised to indicate that DOE will present all potential preliminary remediation goals (e.g. risk-based and ARAR-based) while indicating a neutral position on which is the more proper to use at this time.

62. Commenting Organization: U.S. EPA Commentor:
Pg. # 3 Section # 10.1.2 Paragraph # Sent./Line # 29 & 32
Original Comment # 155

Comment: The text should explain more fully how chemical-specific Applicable, Relevant and Appropriate Requirement (ARARs) will be "subtracted" from the allowable dose limit and how the remaining dose limit will be apportioned to other radionuclides. An example would be helpful.

Response: We are moving away from this preliminary thinking. We will present chemical (or radionuclide-specific PRGs based on ARARs and acceptable risks (e.g., 10^{-6}). We will be using the optimization model presented in Section 10.0 to track sitewide risks and insure that total risks do not exceed 10^{-4} .

Action: Section 10.0 will be revised in accordance with the comment response.

63. Commenting Organization: U.S. EPA Commentor:
Pg. # 7 Section # 10.1.2 Paragraph # 2 Sent./Line # 3-15

Original Comment # 156

Comment: The focus on uncertainties in this and many other sections seems to indicate that the final document will have this as a major theme. Hopefully, these discussions will be reasonable attempts to define limits for readers because a strongly biased message could greatly undermine the credibility of the document.

Response: DOE agrees that the discussion of uncertainties in the work plan addendum, as well as the discussions in subsequent risk assessments, should describe the realistic limits of estimated risks in an unbiased manner. DOE recognizes that at each step of the risk assessment process, source term estimates, transport parameters, and exposure parameters are taken from their respective distributions of possible values so as to overestimate the source, transport, and exposure. The combination of estimated values (e.g., parameters) exceeding the mean or median value for each step of the risk assessment will cause the final risk. In many cases this estimation will greatly exceed the "95 percent confidence level" for the calculated risk. Therefore, the overall uncertainty of the risk is such that risks exceeding the estimated (reported) risk are much less likely than risks lower than the reported value. (See also Comment Nos. 108, 119, and 260.)

Action: Sections 9.5 and 10.1.2 will be revised to improve the explanation of sources and magnitudes of uncertainties that can lead to overestimation and underestimation of risks.

264. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # 11 **Section # 10.2.3.2** **Paragraph # 2** **Sent./Line # 9-13**
Original Comment # 157

Comment: Worker exposure via incidental ingestion of soil should also be considered.

Response: Remediation workers are subject to strict controls on drinking and eating while in Exclusion or Contamination Reduction Zones on a Superfund Site. To presume otherwise would be to assume that the remedial operations will be in violation of the letter, spirit, and intent of federal and state law (e.g., 29 CFR 1910.120). However, a construction intruder will be added to Section 5.1.4.3.

Action: A construction intruder scenario will be added to Section 5.1.4.3.

265. **Commenting Organization:** U.S. EPA **Commentor:**
Pg. # A-2 **Section # 2.0** **Paragraph #** **Sent./Line # 17-30**
Original Comment # 158

Comment: Attachment 1 - It would seem more appropriate to discuss the available data early in the report, as a separate section, and then discuss the constituents of potential concern subsequently.

Response: The outline in Attachment I is patterned after the example outline in Chapter 9 of RAGS. In baseline risk assessment reports produced for the FEMP RI/FS the data

are discussed in Section 2.0 of the risk assessment and constituents of potential concern are determined at the end of Section 2.0. However, the data are actually presented in the Remedial Investigation Report (Section 4.0 entitled: Nature and Extent of Contamination"). Thus, the risk assessment, as an integral part of the RI Report, is dependent on the presentation of available data in earlier sections of the RI document.

Action: No text change is required.

56. Commenting Organization: U.S. EPA Commentor:
Pg. # A-4 Section # 5.1 Paragraph # Sent./Line # 28-36
Original Comment # 159

Comment: Attachment 1 - The predominance of chemical terminology (hazard quotient, hazard index) over radiological terminology seems to indicate that this section will focus on chemical issues. Was this the intent?

Response: It is not the intent of the addendum to focus on chemical issues over radiological issues in Section 5.1. Please note that radionuclides are carcinogens; therefore, the bullet-items in Section 5.1 of the outline that refer to "carcinogenic risk of substances" address radionuclides as well as carcinogenic chemicals.

Action: No text change is required.

57. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # Section # Paragraph # Sent./Line #
Original Comment # (160)

Comment: General Comments - One major conclusion of the meeting was that in order to evaluate and approve the workplan, the BTAG would need to have a better description of the site data, especially biological data, which will be used for the ecological assessment. The necessary information would include a description of the numbers, types, locations, methods and parameters analyzed for environmental, and especially biological samples.

In addition, for ecological risk assessments, which do not identify site impacts, estimates of exposure and toxicity must be conservative. Ecological investigations can assess toxicity and/or exposure directly through lab or field investigations (unlike human health assessments). However, results of the risk assessment may be useful to focus appropriate field investigations. Note that sometimes less conservative action levels result from field investigations.

Consequently, if the ecological assessment must use modeled values, the models must be conservative and validated through field investigations. Examples of data which should be field-validated include surface water concentrations, tissue concentrations (plant and animal), ambient toxicity, etc.

Response: DOE and contractor personnel are available to brief BTAG and other EPA personnel on biological data available for the FEMP, and have been made available in the past. U.S. EPA has also been provided hard copy downloads from the RI/FS database listing data on radionuclide and chemical analyses of biological samples. U.S. EPA has also been provided the Biological Resources Sampling and Analysis Report, a summary of these data and of threatened and endangered species surveys. The other studies cited in the work plan addendum have only recently been completed and have not yet been reviewed by DOE. They will be identified and summarized in the Site-Wide Characterization Report.

The models described in the work plan addendum are conservative in the sense of being protective. Site-specific data will be used wherever available for current exposure scenarios in the ecological assessment. However, much of the focus of the assessment is on the future consequences of the no action alternative. It is not possible to "validate" these predictions via field investigations unless a no action alternative is actually selected.

Action: No text change is required.

268. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 3-2 Section # 3.1 Paragraph # Sent./Line # 22-30
Original Comment # (161)

Comment: As mentioned above, the BTAG cannot determine whether the data was collected in such a way (sample numbers, methods, etc.) that it is usable. The BTAG requested to review that information before drawing conclusions about whether the "data to be considered" should be considered.

Response: DOE and contractor personnel are available to brief BTAG and other EPA personnel on biological data available for the FEMP, and have been made available in the past. U.S. EPA has also been provided hard copy downloads from the RI/FS database listing data on radionuclide and chemical analyses of biological samples. U.S. EPA has also been provided the Biological Resources Sampling and Analysis Report, a summary of these data and of threatened and endangered species surveys. The other studies cited in the work plan addendum have only recently been completed and have not yet been reviewed by DOE. They will be provided in the Site-Wide Characterization Report.

The models described in the work plan addendum are conservative in the sense of being protective. Site-specific data will be used wherever available for current exposure scenarios in the ecological assessment. However, much of the focus of the assessment is on the future consequences of the no action alternative. It is not possible to "validate" these predictions via field investigations unless a no action alternative is actually selected.

Action: No text change is required.

269. Commenting Organization: U.S. EPA Commentor: Helmer

011

Pg. # 3-5 Section # 3.4 Paragraph # Sent./Line # 21-31
Original Comment # (162)

Comment: Ecological data bases should be included in this list such as the EPA AQUIRE (AQUatic Information Retrieval).

Response: Ecological databases will be investigated for inclusion in the toxicity database. It should be noted that toxicity values for aquatic organisms will be used only for those chemicals of concern for which U.S. EPA Ambient Water Quality Criteria or Ohio Water Quality Standards are unavailable. The IRIS and HEAST databases cited in the text also contain information valuable to ecological assessment.

Action: Request U.S. EPA's assistance in accessing AQUIRE and other U.S. EPA ecological databases.

270. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 4-1 Section # 4.1 Paragraph # Sent./Line # 10
Original Comment # (163)

Comment: ~~Total organic carbon and total organic halogen can be very important for ecological assessment (for evaluating sediment toxicity, etc.), and such data should be retained.~~

Response: The statement in question refers to evaluation of suitability of data to be used in quantitative risk assessment (i.e., chemical and radionuclide concentrations) and is drawn directly from EPA guidance. This does not imply that data useful in evaluating likely exposures, for example TOC in sediments, will not be used in the risk assessment.

Action: No text change is required.

271. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 4-3 Section # 4.2 Paragraph # Sent./Line # 21
Original Comment # (164)

Comment: The document must show how statistics used to evaluate a data set are appropriate statistics for that data set (e.g., in lines 32-36 of this page, data must be tested for normality before using student's [sic] t-testing). As the document currently exists, it proposes using the same statistical evaluations for most data sets. The methods proposed are generally used for human health risk assessment, but do not automatically apply to ecological assessment.

Response: The comment appears to refer to Page 4-5, not 4-3. The following response assumes that this is the case.

It is unclear why statistical methods proposed to evaluate chemicals of potential concern for human health risk assessment purposes would be unsuitable for ecological assessment. The intent of the analysis is to determine whether a chemical is present at concentrations above local background levels, independent of the

potential risk posed by exposure. The resulting risk assessment will address the specific and potentially different concerns of human and ecological risk assessment.

Action: Sections 4.2 and 4.3 will be revised in accordance with the resolution of statistical methodology to be used for RI/FS data at the FEMP.

272. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 4-5 Section # 4.3 Paragraph # Sent./Line # 5-7
Original Comment # (165)

Comment: The Remedial Project Manager and/or BTAG must decide whether contaminants can be excluded from further evaluation based on a review of available data, including the number of times a contaminant is detected in a particular area.

Response: The Remedial Project Manager and/or BTAG can evaluate the identification of constituents of potential concern for the site-wide risk assessment and operable unit risk assessments as they are submitted for approval.

Action: Section 4.3 will be revised to describe the methodology for selection of constituents of potential concern.

273. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 4-6 Section # 4.3 Paragraph # Sent./Line # 1-5
Original Comment # (166)

Comment: A chemical of potential concern should not be eliminated based on its site-related mean since isolated areas of high contamination could be overlooked. The paragraph should be deleted.

Response: DOE agrees with the comment. (See also Comment Nos. 17, 137, 154, 217, 218, and 219.)

Action: Section 4.3 will be revised to describe the methodology for selection of constituents of potential concern.

274. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 4-6 Section # 4.3 Paragraph # Sent./Line # 6
Original Comment # (167)

Comment: Although potassium is a nutrient, K-65 should not be eliminated from chemicals of potential concern.

Response: Perhaps the comment is intended to refer to the K-40 isotope of potassium, a K-65 isotope of potassium does not exist. At the FEMP, "K-65" refers to residues from historical processing of uranium-bearing ores. Potassium-40 "K-40" is a non-series primordial radionuclide (NCRP Report No. 94, 1987). This means that it is a naturally-occurring radionuclide; however, it is not a member of any of the three natural decay series (U-238 series, U-235 series, or Th-232 series). Because all

isotopes of an element behave the same chemically, K-40 is readily incorporated into the human body, which uses potassium in many basic physiological functions. There is no reason to suspect that K-40 is present at the site in other than naturally-occurring concentrations and quantities.

Action: No text change is required.

275. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 4-6 Section # 4.3 Paragraph # Sent./Line # 14-31
Original Comment # (168)

Comment: The screening procedure discussed is not appropriate for ecological assessment. It is not appropriate for aquatic receptors and exposure because reference doses (RfDs) are not based on ambient toxicity. Also, since RfDs were developed for humans, they are not applicable to small mammals. The procedure may be acceptable if an uncertainty factor is added.

Response: This section pertains only to human health risk assessment. (See also Comment Nos. 23 and 160.)

Action: Section 4.3 will be revised to indicate that the concentration-toxicity screening procedure will be considered only for human health risk assessments.

276. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 5-9 Section # 5.1.1.7 Paragraph # Sent./Line #
Original Comment # (169)

Comment: Figure 5-4 should be clarified (it does not clearly show which areas are wetlands).

Response: This was due to poor photocopier reproduction. Also, the title requires clarification.

Action: Check copies of Figure 5-4 for clarity in producing the revised work plan. Eliminate "And Other Waters of the United States" from the title.

277. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 5-10 Section # 5.1.1.7 Paragraph # Sent./Line # 9-12
Original Comment # (170)

Comment: This section should state whether state endangered, threatened, or special concern species inhabit the site.

Response: State endangered, threatened, and special concern species do not inhabit the FEMP site. The range of the cave salamander, a state endangered species, overlaps the FEMP, but was not found during RI/FS studies. This will be clarified in the text.

Action: On page 5-10, add as last sentence of second paragraph: "The range of the cave salamander, a state endangered species, overlaps the FEMP, but was not found during RI/FS studies."

278. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 5-10 Section # 5.2 Paragraph # Sent./Line # 26-27
Original Comment # (171)
- Comment: Aging of radionuclides must be considered over the entire site rather than only in source areas.
- Response: The "sources" discussed in Section 5.1.2, page 10, lines 13 to 27 refer to the list in Table 5-1. The collective list in Table 5-1 includes all of the component sources and environmental media that comprise the entire site. Please see Table 5-1.
- Action: No text change is required.
279. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 5-20 Section # 5.2.1 Paragraph # Sent./Line #
Original Comment # (172)
- Comment: The BTAG asked 1) whether all of the possible exposure pathways will be used for data analysis and 2) to review data relevant to these pathways.
- Response: All of the potential exposure pathways identified and presented in Section 5.2 were considered for selection of the exposure pathways to be quantitatively evaluated in the human health risk assessment. The exposure pathway selection process is discussed in Section 5.3 and the list of exposure pathways tentatively selected to be quantitatively evaluated in human health risk assessments is also presented in Section 5.3.
- All possible ecological pathways will not be evaluated, but all data will be reviewed by project staff. For example, microbial communities and deeply rooted plants could be exposed to groundwater, but insufficient methodology exists in the literature to estimate either potential exposures or the ecological implications of such exposure. Nonetheless, available data and model predictions on future levels of constituents in groundwater will be reviewed to evaluate potential effects on aquatic organisms of groundwater release to the surface. The discussion of the groundwater pathway to ecological receptors will be rewritten to clarify this.
- Action: Replace page 5-21, lines 3-9 with the following: "Ecological receptors may also be exposed to constituents in groundwater and surface waters. Exposure of aquatic organisms to constituents in groundwater could occur indirectly by seepage of groundwater into surface waters or by extraction of groundwater by humans, with subsequent release to surface waters. Potential pathways by which ecological receptors could be exposed to contaminants in surface water include ingestion, direct exposure of aquatic organisms, and indirect exposure via food chain uptake."
280. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 6-24 Section # 6.2 Paragraph # Sent./Line # 9
Original Comment # (173)

Comment: Sorption partition coefficients (K_d) are normally site specific for inorganics, and strongly dependent upon total organic carbon for organic contaminants. Therefore, surface water concentrations obtained using the proposed model must be validated somehow, or the model output must be used conservatively.

Response: Due to the uncertainties associated with fate and transport modeling, it is DOE's intention to carefully review all model results and to use their results in a conservative fashion. This includes the EPA's USLE and MUSLE methodology.

Action: No text change is required.

281. **Commenting Organization:** U.S. EPA **Commentor:** Helmer
Pg. # 7-23 **Section #** 7.4.1 **Paragraph #** **Sent./Line #**
Original Comment # (174)

Comment: Because a large portion of contaminants consumed by herbivores/omnivores via vegetation consumption can come from wind-blown soil on plant surfaces, results of the Baes model require validation or must be used conservatively.

Response: Aerial deposition has been added to this pathway.

Action: The text will be revised to reflect the response.

282. **Commenting Organization:** U.S. EPA **Commentor:** Helmer
Pg. # 7-28 **Section #** 7.4.2.1 **Paragraph #** **Sent./Line #**
Original Comment # (175)

Comment: A top carnivore, such as an owl or hawk, should be included in this list of receptors. Also, the vegetation intake calculation must use dry weight concentrations for soils and plants. This section should also clarify which of the animals listed are considered herbivores and which omnivores (American robin, red fox, raccoon). Finally, the nine samples mentioned may not be adequate to assess mammal bioaccumulation of contaminants. Again, a review of the data, including methods, is necessary to determine the data's adequacy.

Response: a) DOE agrees with the comment. The red-tailed hawk will be added to the list of indicator species. b) The estimation of contaminant concentrations in vegetation will be based on the concentration in soil on a dry weight basis. The calculated dry weight concentration in vegetation will then be converted to wet weight and intake by herbivores and omnivores determined. This degree of detail was not felt necessary for inclusion into the work plan addendum. c) DOE agrees with the comment. Details on the food habits and routes of exposure to contaminants for each of the indicator species would be useful to the reader. d) The FEMP mammal sampling data will be used only to supplement the modeling effort, not as a primary data source or a validation of the modeling effort. These data have previously been made available to U.S. EPA.

- Action:
- a) Change Section 7.4.2.1, Page 28, Line 19 to read: "migratorius), red fox (Vulpes vulpes), and red-tailed hawk (Buteo jamaicensis) (Facemire et al. 1990)."
 - b) No text change is required.
 - c) Change Section 7.4.2.1, Page 28, Line 19 by insertion of: "Exposure pathways of terrestrial indicator species to FEMP contaminants include the following:
 - Ingestion of contaminated soil, vegetation and water, and exposure to external radiation by white-tailed deer.
 - Ingestion of contaminated vegetation, insects/earth-worms and water, and exposure to external radiation by white-footed mice.
 - Ingestion of contaminated fruits, fish and water, and exposure to external radiation by raccoons.
 - Ingestion of contaminated wetland vegetation and water, and exposure to external radiation by muskrats.
 - Ingestion of contaminated fruits, earthworms and water, and exposure to external radiation by American robins.
 - Ingestion of contaminated white-footed mice or white-tailed deer, fruits and water, and exposure to external radiation by red fox.
 - Ingestion of contaminated white-footed mice and water, and exposure to external radiation by red-tailed hawk."
 - d) No text change is required.

283. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 7-29 Section # 7.4.2.1 Paragraph # Sent./Line # 23-29
Original Comment # (176)

Comment: In lines 23-29, a default value of one is used for muscle-to-muscle and soil-to-muscle transfer coefficients. While a value of one may be somewhat conservative for contaminants which do not bioaccumulate to a great degree, it is likely low for bioconcentrating contaminants. Some bioaccumulation factors should be available from the following sources: scientific literature, the Office of Water (sludge transfer coefficients - some of which are usable while some are not), the Environmental Criteria and Assessment Office (biomagnification factors). Again, by conducting appropriate field investigations following this screening, site impacts can be more assessed directly.

Response: Attempts will be made to obtain bioconcentration factors for those metals and organic compounds that are expected to have muscle-to-muscle and soil-to-muscle bioconcentration factors exceeding one.

Action: No text change is required.

284. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 7-30 Section # 7.4.2.1 Paragraph # Sent./Line # 1-2
Original Comment # (177)

281

Comment: Since robins may undergo a high level of contaminant exposure via earthworm ingestion, and onsite robins may be suffering impacts (e.g., shorter wings as documented in the Facemire report), the earthworm exposure pathway should likely be measure [sic] directly.

Response: Direct monitoring of residue concentrations in the American robin and earthworms could provide information useful in the interpretation of the Facemire results. However, collection of samples to obtain estimates of contaminant uptake by earthworms would require the sampling of earthworms and soil from similar locations and the subsequent analysis of 80 chemicals of potential concern. This information is unlikely to influence the ecological risk assessment sufficiently to affect the selection of remediation goals for the FEMP.

Action: No text change is required.

285. **Commenting Organization:** U.S. EPA **Commentor:** Helmer
Pg. # 7-30 **Section #** 7.4.2.2 **Paragraph #** **Sent./Line #** 7-28
Original Comment # (178)

Comment: ~~Radiation doses to terrestrial mammals must be assessed in the same way toxicity data was developed for a particular radionuclide. For example, if toxicity data was developed for dose to bone tissues only, appropriate data must be available for comparison.~~

Response: Organ/tissue-specific radiological dose conversion factors do not exist for animals, they have only been derived for humans. Equation 7-31 in Section 7.4.2.2, page 30 is a generic relationship derived from basic radiological principles of dosimetry. It estimates absorbed dose rate (rad per year) per gram of matter. It is not tissue or organism specific. (See also Comment No. 76.)

Action: Text will be revised to provide complete derivation of equation 7-31 in response to Comment Nos. 76, 80 and 81.

286. **Commenting Organization:** U.S. EPA **Commentor:** Helmer
Pg. # 7-31 **Section #** 7.4.3 **Paragraph #** **Sent./Line #** 1-15
Original Comment # (179)

Comment: A terrestrial species consuming aquatic organisms must be added to the exposure assessment. For example, fish should be added to the raccoon diet.

Response: The raccoon is assumed to ingest contaminated fruits and fish.

Action: Please see response to Comment No. 282.

287. **Commenting Organization:** U.S. EPA **Commentor:** Helmer
Pg. # 8-6 **Section #** 8.4.3 **Paragraph #** **Sent./Line #** 32-34
Original Comment # (180)

Comment: Calculated risks for separate toxic contaminants and radionuclides should be clearly distinguishable.

Response: As noted.

Action: Individual toxic and cancer effects will be presented.

288. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 8-7 Section # 8.5 Paragraph # Sent./Line # 11-12
Original Comment # (181)

Comment: The sentence beginning "Laboratory studies of toxicity...." should be deleted since the doses wildlife are exposed to are unknown at this point.

Response: The statement in question is generic, not specific to the FEMP.

Action: No text change is required.

289. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 8-7 Section # 8.5 Paragraph # Sent./Line # 16-18
Original Comment # (182)

Comment: Ambient toxicity testing can be used to assess the effects of multiple contaminants on aquatic organisms. Also, antagonistic effects are not likely to be applicable with the contaminants at this site, and the nature of this assessment mandates conservative assumptions. Therefore, delete the reference to "antagonistic."

Response: The statement in question is generic, not specific to the FEMP. However, "antagonistic" will be deleted from the sentence.

Action: Page 8-7, Line 17: Delete "or antagonistic".

290. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 8-7 Section # 8.5 Paragraph # Sent./Line # 19-24
Original Comment # (183)

Comment: Ambient Water Quality Criteria (AWQC) should be used as one primary assessment reference for those contaminants with AWQC available.

Response: AWQC will be used as a primary assessment reference, as stated in Section 8.3.

Action: Page 8-3, Line 31: Change "Standards" to "Criteria".

291. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 9-8 Section # 9.5 Paragraph # Sent./Line # 3-6
Original Comment # (184)

Comment: Additional field ecological investigations may be necessary to assess the accuracy of assumptions.

Response: Additional field investigations will be proposed if they are found to be necessary to inform remedial action decision-making.

Action: No text change is required.

92. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # 10-3 Section # 10.1.1 Paragraph # Sent./Line # 1-3
Original Comment # (185)

Comment: Preliminary remediation goals should include not only to perform an environmental evaluation, but also to remediate environmental impacts.

Response: The comment is unclear. It addresses a quote from the NCP. RAGS Part B provides guidance only for protection of human health, "no consideration is given to ecological effects". DOE will use ambient Water Quality Criteria as PRGs and these address environmental effects.

Action: No text change is required.

93. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # A-2 Section # 1.3 Paragraph # Sent./Line # 9-16
Original Comment # (186)

Comment: This section should include a summary of the findings of the Facemire report.

Response: The major findings of the Facemire report will be summarized in the ecological assessment (Chapter 6 in the outline), for example, characterizations of habitats on the property, population estimates of deer and small mammals, and population genetics and ecological diversity studies. A species list for the FEMP, based largely on the Facemire study, will also be provided as an appendix to the Site-Wide Characterization Report.

Action: No change will be made in the text because Attachment A is intended as a general outline for a risk assessment, not a detailed description of the contents of FEMP risk assessments.

94. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # A-3 Section # 3.3 Paragraph # Sent./Line # 23-25
Original Comment # (187)

Comment: This section must include a summary of existing data, including a summary of sampling strategies, etc., as previously described. BTAG would like to review this section before the first draft of the risk assessment is completed. Also, this report should include a description of how Ohio Environmental Protection Agency

guidelines were followed in the benthic/fish community surveys conducted on Paddys Run.

Response: The field sample analytical results and summaries of investigations at the site are actually to be presented in the operable unit Remedial Investigation Reports and the Site-Wide Characterization Report. Section 3.3 of a typical risk assessment for the FEMP RI/FS will present sufficient data (field sample analytical results and exposure pathway data) to quantify the appropriate exposure pathways for the risk assessment.

Action: No text change is required.

295. **Commenting Organization:** U.S. EPA **Commentor:** Helmer
Pg. # A-4 **Section #** 4.1 **Paragraph #** **Sent./Line #** 2-11
Original Comment # (188)

Comment: An assessment of aquatic water and sediment toxicity should be included here. Also, the results should be summarized in reference to findings in the Facemire report and aquatic community studies.

Response: Section 4 is the Toxicity Assessment for human health only. Ecological toxicity information will be provided in the ecological assessment in Section 6.

Action: No text change is required.

296. **Commenting Organization:** U.S. EPA **Commentor:** Helmer
Pg. # A-4 **Section #** 4.2 **Paragraph #** **Sent./Line #** 12-17
Original Comment # (189)

Comment: An assessment of reproductive toxicity should be included here.

Response: In cases where chemicals have RfDs based on reproductive effects, reproductive effects will be evaluated. (See also Comment No. 295.)

Action: No text change is required.

297. **Commenting Organization:** U.S. EPA **Commentor:** Helmer
Pg. # A-4 **Section #** 5.0 **Paragraph #** **Sent./Line #** 26+
Original Comment # (190)

Comment: A section should be added which considers ecological pathways of exposure in future scenarios.

Response: Ecological pathways, both present and future, will be discussed in the ecological assessment in Section 6.0 in the risk assessment.

Action: No text change is required.

98. Commenting Organization: U.S. EPA Commentor: Helmer
Pg. # A-5 Section # 6.0 Paragraph #
Original Comment # (191)

Sent./Line # 34-41

Comment: The summary of the Facemire results could also be placed in this section, as well as the aquatic toxicity assessment.

Response: All material required for ecological assessment will be included in Chapter 6. (See also Comment Nos. 293 and 295.)

Action: No text change is required.